Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 71 New York, Saturday, May 18, 1918 *Number* 20

Problems Involved in Interconnection

INCREASE in the size of transmission systems has been attended with a great amount of interconnection between auxiliary stations on the same initial system, between parts of a single network, and even between separate networks which have found it desirable to provide facilities for exchange of power. Speaking in broad terms, the practical working out of interconnections, involving the running of many scattered stations in parallel, has been solved very successfully. The length of the lines involved furnishes a sort of electrodynamic buffer which is very effective in preventing disturbing reactions between two stations. Important information on the results that are practically attainable is given in the current issue in the article by J. P. Jollyman, engineer of the Pacific Gas & Electric Company.

It appears that fairly long lines operating at voltages even 10 per cent apart can be interconnected without particular difficulty and that very little disturbance is created by additional lengths of line unless the charging current is exceptionally large. Sometimes in paralleling two lines of different total length at two common points trouble is caused by unequal distribution of load. The solution for this difficulty is to parallel the systems at one point only so that unequal distribution of load can be minimized.

Apparently the chief annoyance which has been found in practice is caused by connecting two fairly large systems with a long line having relatively small carrying capacity. In such instance the waterwheel governors may fail to work in harmony and establish a condition of hunting even up to the extent which will cause the systems to drop out of synchronism. With connections of large carrying capacity this is much less likely to occur. The same risk of going out of synchronism is encountered when energy is exchanged between two systems through a frequency changer, as now and then occurs. This case is somewhat similar to the hunting of synchronous converters, an occurrence that was unpleasantly familiar in the early days of their use.

Interconnection is the order of the day between great systems of the Pacific Coast. Some eight or ten interconnections with capacities up to 10,000 kw. are in daily use and excellent results are being obtained from every standpoint. A careful investigation was made last year of the situation. In a few instances it was found that considerable benefit could be realized by making additional interconnections. Other possible interconnections would have cost more than the benefits would have warranted. The chief problem is to avoid conditions which will lead to hunting. These are now pretty well understood, and little serious trouble is to be expected from them.

The Large Joint Convention in California

THE Far West has consistently lived up to the policy that conventions in war time are even more necessary than before. This belief has led to extremely helpful meetings in which the paramount purpose has been the extension of "win the war" service. The joint convention held last week at Del Monte, Cal., was not only typical of this spirit but it was the more effective and made greater progress because of a similar meeting last year at Riverside. This year no preliminaries were necessary, and work was begun at once on a program in which "win the war" service was the underlying thought in every session. The trend toward consolidation of systems showed markedly in discussions in which representatives of the Railroad Commission, the Petroleum Administrator and others directly interested joined. Discussions showed how absolutely essential to the conduct of war industries the production of energy is.

It was also brought out that the producers of electrical energy are now wholly dependent upon government action. Government aid is being sought in financing further developments, the use of fuel will be subject to government refusal, priority orders must be secured for additional equipment, incomes can be maintained only if rate increases are permitted, and permission must be secured even now to refuse service beyond capacity. In short, war conditions are tending to make the government paternal in character. Labor alone, it was shown, is the one thing thus far uncontrolled, and some hold that it would be in much more stable condition were it too under government regulation.

Sessions of the jobbers' convention advanced the perfection of organization; central-station representatives discussed economies of various kinds and also means of meeting the increasing energy demands, while all joined with the dealers in furthering the co-operative commercial educational campaign that means so much to improved merchandising facilities. But, perhaps most important of all, the convention fostered more intimate acquaintance of the sort that begets confidence. Those in attendance carried away a generous portion of the enthusiasm so helpful in these times, the warm-hearted enthusiasm which seems so natural a feature of Western conventions.

Operation of the Fuel Zone System

WE PRESENT for our readers this week a map of the zone system established by the government authorities for bituminous coal, showing the districts into which the country is divided for the purposes of coal distribution, with suitable explanation of the available sources applying to these districts. Of course, our readers well understand the fundamental purpose of this specified distribution, to eliminate the unnecessarily long hauls which have characterized coal movements in the past. So long as there was no fuel shortage every one turned to some favorite sort of coal, whatever the length of the haul that brought it to him, unless the price was raised by transportation to an entirely prohibitive figure. Even so the favoring of long hauls in general increased the complexity of distribution until if one had marked out on a map the distribution lines from each source of coal the whole system would have reached amazing complexity. The general upsetting of ordinary conditions by the demands of the war rendered somewhat desperate measures necessary, and the zone system is the logical result.

We long ago passed out the general warning that the time was coming when the burning question would be not what kind of fuel but any kind of fuel, and that users of coal had better make up their minds to accustom themselves to that which could be obtained within comparatively easy reach. A great many experiments have been made in the utilization especially of low-grade fuels, and not a few large users have found it to their advantage that some easily available sources could be utilized quite irrespective of past custom. The present regulations will enforce more liberal views as to the possibilities of fuel, sometimes at considerable inconvenience to the individual user, but here as elsewhere those who have remembered that we are at war and have looked ahead toward some of the necessary results will find themselves in the best position to face the exigencies that arise as a result of the situation.

A Successful Change of Systems

THE brief account by M. C. Dean of the New York & Queens Electric Light & Power Company concerning the general change-over in that system ought to arouse interest. The situation to be met was a serious one. The distribution circuits had to be increased in rating something like 30 per cent. In one large district the current-carrying capacity of both feeders and regulators had been reached, and it was necessary to apply means for immediate relief. Of the three courses open —additional 2300-volt, two-phase feeders; high-tension feeders to relieve those operating at 2300 volts, and, finally, changing from a 2300-volt, two-phase, to a four-wire, three-phase system—the last mentioned was chosen. It was found that the necessary rating could be provided for less than half the expenditure required by other methods and that the feeders would have 50 per cent greater capacity as three-phase feeders than as two-phase feeders. Besides this, the line losses are reduced. The four-wire, three-phase system is one of the most economical in the use of copper; wherever it has been used it has worked out admirably. The only reason that it has not been employed more extensively seems to be sheer timidity on the part of engineers.

The chief work that had to be done in making the change-over was in connection with the transformer banks serving power loads. Here old two-phase customers were allowed to remain, but new ones are furnished from the three-phase service. To permit this, one transformer from each power bank was replaced by two of half the rating, having 10 per cent taps giving the necessary phase relations. To simplify the changes this replacement was made in advance, leaving the two transformers simply in multiple, to be swung into the three-phase connection later. No change was made in the overhead circuits, which were already four-wire.

Since the change-over was made everything has been working smoothly, and as a result it has been unnecessary to install additional two-phase feeders. The line losses have been lessened by 200 kw., enough to pay full interest on the cost of the change-over, and the voltage regulation has been improved 100 per cent. Conversion of the rest of the company's distribution is likely to follow. The scheme is well worth the attention of other companies which find themselves short of feeder capacity.

Results from the Burning of Powdered Coal

THE coal crisis has driven engineers to extremities for a suitable supply of fuel. With the cost of liquid fuel rising rapidly, with wood at nearly prohibitive figures, and with the zone distribution ahead, compelling the use of fuel within easy reach, one is hard put to it for hope of economy. The conditions have caused reversion to several schemes which have been tried before with varying success. Briquetting has taken a new lease of life. Peat is coming again into notice, and the use of pulverized coal blown into the fire box by compressed air now seems to offer a fair chance for economical working In the current issue A. E. MacInnis gives a very instructive account of some of the experiments with powdered coal made in the Northwest.

One of the most notable installations of this kind is in the plant of the Puget Sound Traction, Light & Power Company of Seattle, on which we commented last year. The final result of that preliminary work was so satisfactory that a new plant for an aggregate rating of 4100 boiler-hp. is now under construction. In the original test the powdered coal was prepared at a nearby briquetting plant where likewise pulverized coal is in use.

The advisable fineness of the finished product depends on the character of the coal. The higher the fixed carbon the further should pulverization be carried. With the local coal here employed it was ground until 85 per cent would pass through a 200-mesh machine and 95 per cent through a 100-mesh. This very finely ground fuel is fed to the boilers by compressed air. In some respects the burning of pulverized fuel is like that of some special coals in that large furnace space is necessary. In this instance a Dutch oven was built in front

of the boiler to give suitable combustion space. A large number of coals were tried. Some of them were fairly good, others particularly poor. All were, of course, thoroughly dried before pulverizing, some running very high in moisture in the raw state.

The net result showed that combustion of pulverized coal can be carried on at good efficiency even in the case of the low grade coals. The fire produced is easy to manage, smokeless and capable of being forced with great rapidity to carry peak loads.

In the new plant raw coal is to be delivered over street-railway tracks and dumped into a bunker which serves as a source of supply. Then it is crushed, dried, powdered coal being used for this purpose, and finally pulverized. From the grinding mills the coal goes over a system of conveyers to the steel bins over the front of the boilers. These have 15 tons capacity and feed the coal to the air blast. Slag pits are provided underneath the furnaces.

Besides this considerable plant for Seattle the Pacific Coast Coal Company is running at two of its own mines banks of boilers fired with pulverized coal, in each case aggregating more than 2000 boiler hp.

The general results thus far reached seem to indicate that under favorable conditions of fuel supply very excellent results can be obtained with powdered coal—good enough at least to encourage further work on a siderable scale. Certainly no subject is more vital to the central-station engineer, and the results which are reported in this case should serve to stimulate further research in other sections of the country.

Sudden Short Circuits of Alternators

WHEN an alternator is running steadily at synchronous speed it is well known that, in addition to its armature resistance, it possesses a certain reactance which is ordinarily considerably greater than the resistance. This apparent reactance is called its "synchronous reactance." It is much greater than would be accounted for by its self-inductance, owing to the effects of armature reaction. It is assumed in dealing with the subject that the changes in the electric circuit take place so slowly that the effects of armature reaction can fully develop. The synchronous reactance will then reveal itself. The synchronous impedance of the armatures will then likewise present itself as the vector sum of the resistance and synchronous reactance.

However, if the electric circuit of the running alternator be changed suddenly, the reactance presented initially in the armature will be much less than the synchronous reactance and will approximate that due to the self-inductance of the armature alone. The initial impedance of the armature, being the vector sum of the resistance and initial reactance, will be much less than the synchronous impedance; so that the initial change of current in the circuit will be greater than that which the synchronous impedance would allow. After the lapse of a few seconds, the armature reaction has time to develop and to restore the armature impedance to its synchronous value. If, then, a sudden short circuit is applied to an alternator near its armature terminals, the initial short-circuit current tends to the value produced by the initial internal emf. divided by the initial vector impedance. This is commonly a much stronger current than flows after a few seconds, when the armature reaction has brought the reactance back to its synchronous value.

The characteristics referred to are unfortunately just the reverse of what a central-station manager would desire to see in force. He would like to have the initial armature reactance large, so that a sudden short circuit would come on gradually and give the time relays a chance to act before the mechanical stresses on the machine became excessive. On the other hand, he would prefer that the synchronous reactance should be small, so far as concerns the automatic regulation of terminal voltage in the machine under imposed changes of load.

With the facts as they are, a sudden short circuit tends to force an enormous initial current through the armature, with correspondingly enormous mechanical stresses in the machine. After a brief interval this current falls off to what may be called its synchronous value. In order to set a limit to the severity of the mechanical blow on the machine in the case of a short circuit just outside the power house, it has become common practice to install external reactors in the station. The fixed reactance of these devices takes the place of some of the lost synchronous reactance in the first stages of a sudden "short."

The belief is now generally accepted that the strength of the short-circuit current from an alternator falls off exponentially from the initial value to the synchronous value. It is not easy, however, to say how rapidly the descent will be made. In other words, the attenuation factors of the alternator field flux and of the armature current depend upon a variety of conditions, which are discussed in detail by N. S. Diamant this week in an extensive article upon the whole subject. In the case of large central-station alternators the matter is of great practical importance.

The Coming Issues

WAR has brought to every one in the electrical industry problems which are so different from those in the past that the only way they can be solved effectively is by the aid of a clearing house through which ideas can be exchanged freely. The ELECTRICAL WORLD recognizes its duty to serve as such a clearing house for the electrical industry and takes this opportunity to invite its readers to make use of it. Among problems which it sees the need of discussing particularly are the following: Shortage of materials, apparatus and labor and how to meet it, making existing equipment serve increased loads, assuring reliability of service, increasing economy of operation, serving war industries, and guarding against fuel shortage next winter, either by assuring an ample supply of coal, adapting furnaces to low-grade coal or a substitute, or utilizing water power. In addition, all companies operating interconnected systems should give others the benefit of their experiences regarding the economies they have effected by interconnecting their plants. Articles in coming issues of the ELECTRICAL WORLD will cover a wide range of subjects along the lines mentioned above.

Operation of Interconnected Systems

Relative Importance of the Problems Which Are Encountered in This Connection—Swinging of Loads Must Be Considered in Connecting Systems, Especially in Those Cases Where Frequency Changers Are Used

BY J. P. JOLLYMAN

Engineer of Electrical Construction Pacific Gas & Electric Company

THE requirements of the times for more power and for the utmost utilization of all existing generating equipment have led to considerable extension of interconnected operation. In some cases the interconnecting lines may be long as compared with any other of the lines operated by either or both of the systems. Sometimes the capacity of the interconnecting line may be small relative to the capacity of the systems tied together. Occasionally the interconnection may be between systems of different frequency involving the use of frequency changers. Under any of these conditions or where a combination of them may be found new operating problems will arise. Some of the experiences in connection with one of the most extensive interconnected networks in this country may be of interest to those who are interested in rapidly expanding systems.

Unless the kva. required to charge the additional line seriously increases the load already carried by the generator or generators, no difficulty should be anticipated from making a considerable extension to an existing line. Even if the charging kva. is considerable, no harm can result aside from that which may be caused by a sudden rise in voltage at the generator terminals when the line is charged.

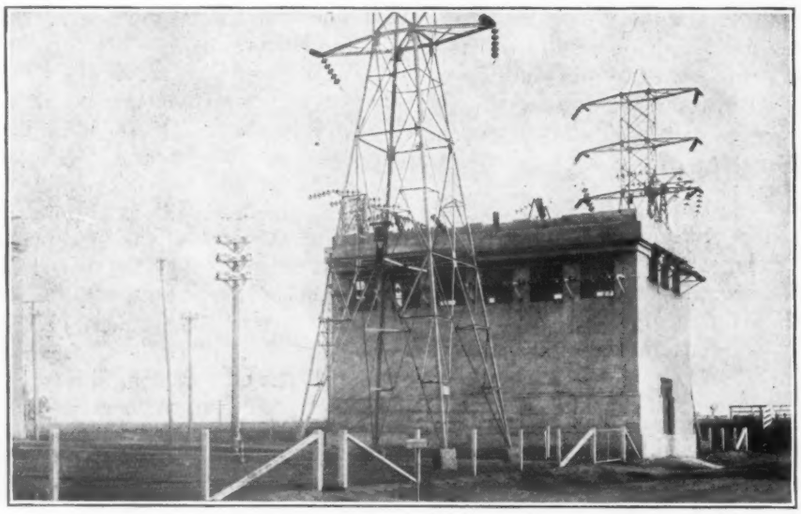


FIG. 1—SUBSTATION NEAR SACRAMENTO, CAL., WHICH SECTIONALIZES TRANSMISSION LINE OPERATING AT 100,000 VOLTS

As is quite generally understood, exact equality of voltage between systems is not necessary when synchronizing over a line of some length. In fact, no difficulty should be experienced with voltages 10 per cent apart or even more if the connecting line is quite long. The only result will be a small exchange of wattless current; the system with the higher voltage will supply some excitation to the other system.

In the development of an interconnected network cases sometimes arise where it becomes desirable to parallel two systems at two points and where the lines connecting these points are of quite different length. In such cases the shorter line or the line with the lowest impedance will naturally take on the most load. To keep both lines fully loaded it will therefore be necessary to distribute the load between the lines and connect them in parallel at one point only. Paralleling of low-tension networks may be prevented by a difference in transformer connections in the parts to be connected, but this obstacle is not peculiar to interconnected operation.

One of the most troublesome situations which can be encountered in interconnecting two systems arises when each has considerable generating capacity and load of its own and the connecting line has considerable length and relatively small carrying capacity. If such a line is heavily loaded, there will be a decided tendency for the system to pull out of synchronism. This tendency arises from the nature of the speed control of transmission systems and may be explained as follows:

Consider two transmission systems A and B, each of which has generating facilities and a load of its own and which are interconnected by a line which transfers energy from system A to system B. Assume that a considerable load comes onto system B. The additional energy required will at first be drawn from the flywheels of all synchronously revolving apparatus, causing a reduction in speed. As the speed starts to decrease the governors will make the prime movers supply more energy to the generators and gradually bring their speeds back to normal. Momentarily, however, some of the energy required to carry the increased load on system B will be taken from the flywheels in system A and will flow over the interconnecting line. With increased load on the line an increased impedance voltage will be required between the two ends; hence there will be an increased difference in phase between systems A and B. The change in phase difference between two large systems may cause a swinging effect between the two systems which will overload the tie line and allow the systems to drop out of synchronism.

The action mentioned may be compared with that which would occur when two steam turbines each carrying a load of its own are coupled with a light shaft

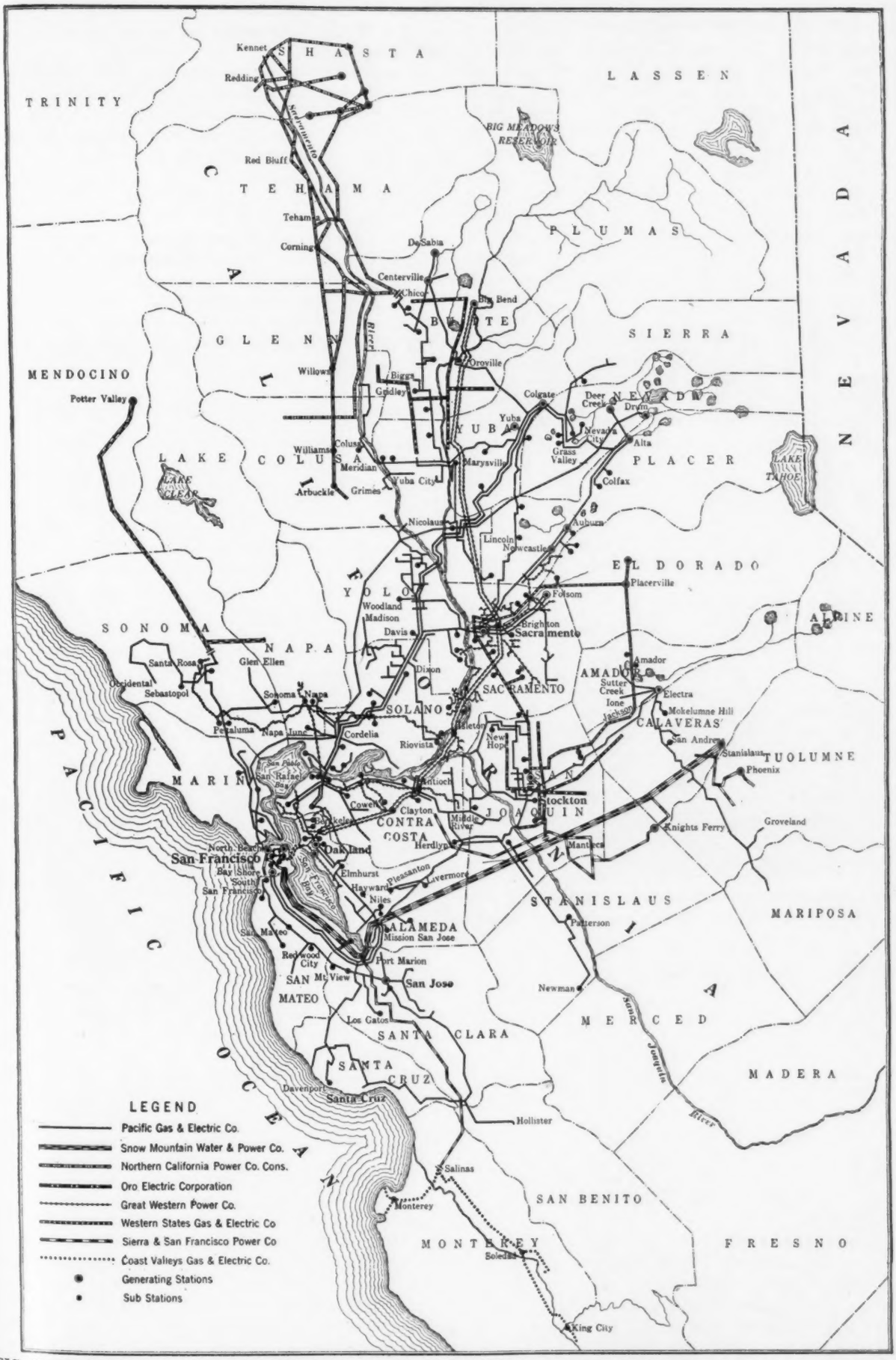


FIG. 2—INTERCONNECTED SYSTEMS LEADING INTO SAN FRANCISCO, EXPERIENCE ON WHICH FORMS THE BASIS OF THE OBSERVATIONS MADE IN THIS ARTICLE

the ultimate strength of which is much less than the rating of the turbines and a considerable load is thrown on one turbine. The energy required to carry the additional load must be drawn from the energy stored in the rotors of the turbines by a reduction of speed. The energy thus drawn from the first turbine must be transmitted over the light connecting shaft, which will thereby be subjected to torsional stresses that will cause a change in the angular position of the two turbines and may even cause the breaking of the shaft. Even if the shaft is not ruptured by the first load change, a torsional oscillation may be set up between the two turbines which will lead to a final rupture in the event of some load change coinciding with an oscillation.

Evidently the condition most likely to cause a "swing" will exist when energy is exchanged first in one direction and then in the other. The only remedy for this difficulty is to avoid overloading the interconnecting line, and especially to avoid establishing a condition that will cause rapid reversals in the flow of energy to take place. If the systems are large, the interconnecting line must have considerable carrying capacity over and above that required to carry the exchange power. This extra capacity must be sufficient to care for the rapid changes in load since the governors on the generators of the system on which a load increase has occurred may not act until after the governors of the other system have increased the supply of energy and thus supplied all the increased load over the interconnecting line.

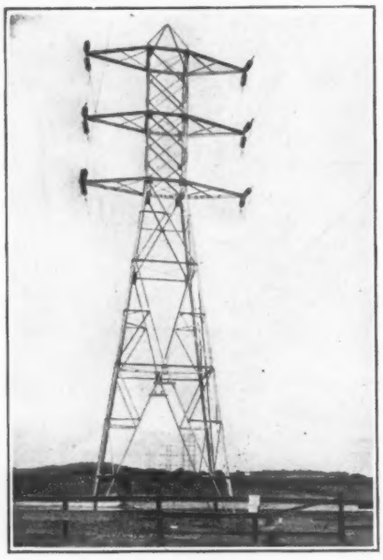


FIG. 3—TRANSMISSION LINE OF ONE OF THE PACIFIC COAST COMPANIES

An interconnection made through a frequency changer acts in a manner similar to a line of considerable length. From no load to full load the shaft of a synchronous motor will lag about 25 electrical degrees behind the phase of the impressed voltage. The same lag takes place between the shaft and the delivered voltage of the generator. In a fully loaded 25/60-cycle frequency changer the relative phase of the 60-cycle system will lag 85 deg. behind its phase for no load on the frequency changer. The difference in phase arises from the fact that the 25-deg. lag of the shaft of the frequency changer, due to full load on the motor, is equal to 60 deg. lag on the 60-cycle generator. To this 60 deg. lag is added the 25-deg. lag of the generator under full load.

Swinging similar to that due to a long small tie line may thus take place between two systems interconnected with a frequency changer. The swinging will be greater in degree with the frequency changer than with the line. There is no way to overcome the difficulty due to the characteristics of a frequency changer unless the load transferred can be kept from fluctuating rapidly.

No difficulty need be anticipated from increased mileage of electrically connected network if the experience of the Western companies operating networks containing over 2000 miles (3218.6 km.) of high voltage circuits may be taken as a guide. In some cases these lines connect points over 400 miles (643.7 km.) apart.

Fuel Oil for State Electrical Plants

United States Consul William Dawson, Montevideo, Uruguay, writes that by a resolution the Uruguayan government has approved the action of the Administration General of State Electrical Plants in declaring that of the 7000 tons of fuel oil on hand in the deposits of the West India Oil Company 5000 tons be reserved for the state electrical plants and that the latter receive the preference in the distribution of cargoes arriving hereafter. The state electrical plants burn fuel oil which is supplied under contract by the West India Oil Company, and one of the clauses of the contract provides that if at any time the supply shall not suffice to meet all demands the state plants shall enjoy preferential treatment.

St. Louis Company Equipping Own Coal Mine

The management of the Union Electric Light & Power Company of St. Louis more than a year ago, appreciating the trend of conditions and anticipating the coal needs of the company, adopted a plan to guarantee as nearly as possible its future fuel requirements. This plan embraced the control and operation of a coal-producing property within a convenient distance of the generating station. In pursuance of it control had been acquired of 3143 acres (1271 hectares) of coal land in Jackson and Perry Counties, Ill., about 5 miles (8 km.) south of Du Quoin, 80 miles (128.7 km.) from St. Louis on the Illinois Central double-track line from St. Louis to New Orleans. On this track a mine is now being developed which will be equipped to screen and prepare 6000 tons of coal daily. Two seams of coal are available, one averaging 4 ft. to 5 ft. (1.2 m. to 1.5 m.) in thickness and the other ranging from 6 ft. to 14 ft. (1.8 m. to 4.2 m.), and the extractable tonnage is estimated at approximately 28,000,000 tons. If an annual production of 800,000 tons is maintained, this mine will last for nearly fifty years. All the coal will be removable through one shaft. The shaft and equipment are being completed as rapidly as possible and are of the most modern and efficient type obtainable. Underground the mine will be electrically equipped and thoroughly up to date in every respect. An adequate water supply is available.

SOUND-RANGE TELEPHONES ON THE FRONT IN FRANCE

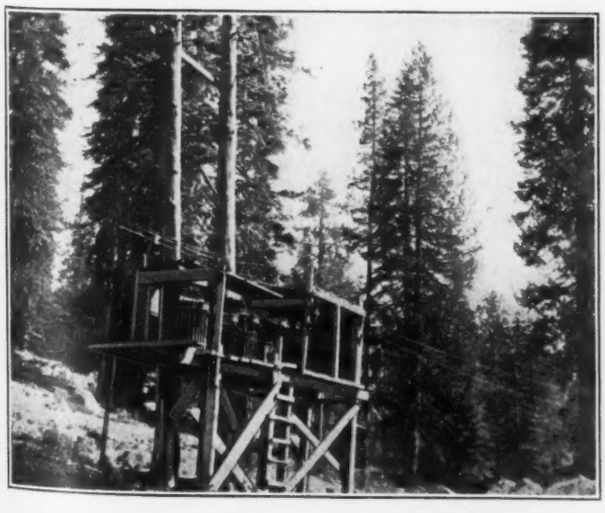
Major-General Bell Describes Success of New System for Ascertaining the Positions of Guns of the Enemy

Major-General J. Franklin Bell, U. S. A., who has lately returned from an inspection trip on the front in France, where he viewed the British, French and American armies, has imparted to the Senate military committee the results of his observations, among which the Washington correspondent of the ELECTRICAL WORLD notes the success of the new sound-range telephone system for ascertaining the positions of enemy guns. The Germans captured one of the telephones and are now also using the system. General Bell says: "Probably the success of the sound-ranging system has been greater than that of any other scientific achievement in the war." General Bell said in part:

All armies now employ scientific methods of locating guns which have never been employed in warfare before. One is known as the sound-ranging method. Briefly, they have observers scattered along a curved line which has been accurately measured, and all of these observers, of whom there are usually six, utilize electrical sound-ranging apparatus by which they report instantaneously the moment they hear the sound of a gun explosion. At a central point another electrical apparatus records these sounds from the six different stations, and by a scientific method they combine the knowledge gained from these six points and succeed in locating with a remarkable degree of accuracy the position of the gun that made the explosion when it was fired.

Each side has a type of telephone which is able to hear distinctly over very considerable distances conversations not intended for the listener, and for a long time the Allies employed this system of gaining information without the knowledge of the enemy; but the Germans captured one of these instruments and discovered that their conversations in the trenches had been listned to for quite a while and that the Allies had thus gained some information in a way which had long puzzled the Germans. New organizations had to be created in order to attend to the type of service which I have just been describing.

Transformers Mounted on Standing Timber



The construction shown herewith, while perhaps novel to distribution engineers in the thickly populated districts of the United States, is employed extensively in the Northwest lumber woods where central-station energy has to be supplied for camp needs.

Moline Plant of Tri-City Company

Since 1907 this station has hardly seen a day when some construction was not in progress. Arsenal and other government work in Rock Island, Davenport and Moline have grown to such an extent that a 200,000-kw. unit is now being installed.

FALLING OFF IN THE TOTAL OF ENGINEERING STUDENTS

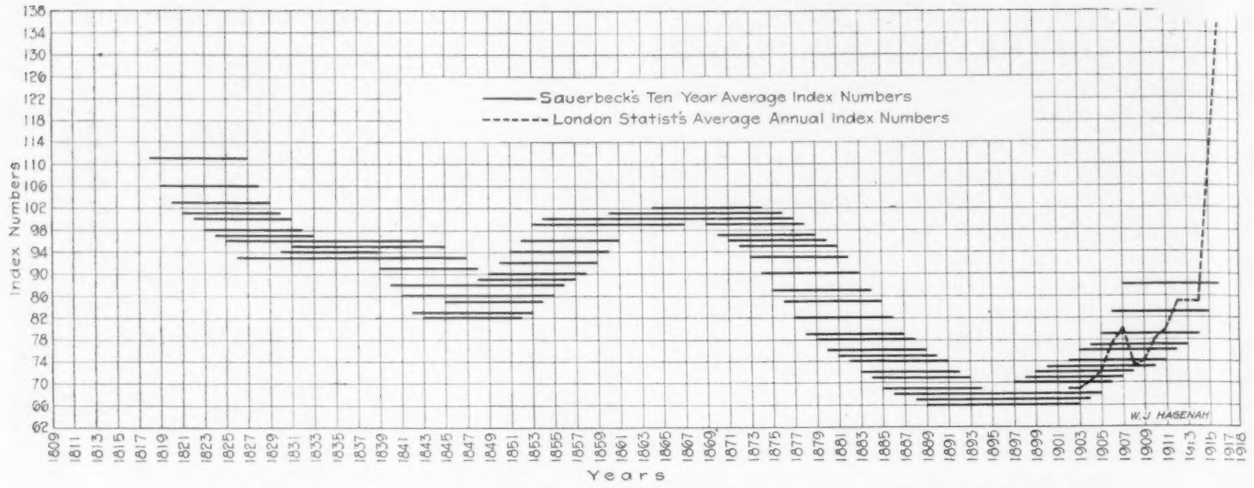
Letter of President Wilson Urging Importance of Maintaining Engineering Studies — Attendance Off 25 to 35 per Cent

A letter from President Wilson to Dean Mortimer E. Cooley of the College of Engineering of the University of Michigan, urging the importance of maintaining the number of engineering students, is receiving extended publicity.

The letter was written as a result of resolutions prepared by a committee consisting of Dean F. L. Bishop, University of Pittsburgh; Prof. C. R. Mann, Carnegie Foundation; Prof. A. E. Kennelly, Harvard University and Massachusetts Institute of Technology, and Dean Cooley, chairman. President Wilson expressed concern at the falling off in the number of engineering students because "it is not only immediately necessary that as many students as possible should prepare themselves for engineering duties in the army and navy, but it is also of the first consequence to the country that there should be an adequate supply of engineers for the period of reconstruction which must follow the war." Parents are urged to keep their sons in the schools.

Dean Cooley, in writing to the ELECTRICAL WORLD, says he believes that it is a fact that the attendance in engineering since this country entered the war has fallen off from 25 to 35 per cent. Hardly a day passes without calls from the army or navy for the more advanced students. Graduating classes this year, he expects, will not be more than half their usual size.

"The average age of engineering graduates," says Dean Cooley, "is nearly twenty-three years. Thus most of the juniors and seniors are eligible to the draft. Even our freshmen and sophomores, many of them, are keen to get into the war. The Engineer Enlisted Reserve Corps and the Naval Reserve Force, now that they have been established, will no doubt keep in college many who would otherwise go."



THE MOVEMENT IN COMMODITY PRICES IN ONE HUNDRED YEARS OF WAR AND PEACE

Commodity Prices and Public Utility Rates

Historical Precedents All Indicate that the Decline in Prices from Their Present High Level Will Be Very Slow Even After Cessation of War—Rate Increases Granted Only for Its Duration Will Be Inadequate

BY WILLIAM J. HAGENAH

Mr. Hagenah presented an extended discussion on this important subject before the Wisconsin Gas and Electrical Association at Milwaukee on March 27. These excerpts from his remarks emphasize the danger of failure to readjust electric rates.

WE ARE witnessing at the present time a most important development growing out of our disturbed economic and political conditions—one which is destined to have a most far-reaching effect on the operations of public utilities. Economists have for some time foreseen and predicted the condition which is now exerting such tremendous pressure on every form of activity, individual as well as corporate and public as well as private. There is hardly an individual or an enterprise that has not already felt this staggering force or is not destined to feel it in the near future, but among all forms of industry which are struggling to effect a readjustment none has suffered so acutely as have the public utilities. I refer to the steadily rising level of prices, to which such decided impetus has been given by our entry into the great European war.

For over fifteen years before the opening of the European war we witnessed in this country a gradually increasing price level. Coincident with this was our great industrial and commercial development.

The mine owner, the manufacturer, the farmer, the tradesman and the professional man met the rising level of prices by shifting the burden through increased charges for their product or his service, but not so with the utility. Its rates were fixed and could not be increased except by action of the proper public authority. So long, however, as the utility has not yet reached the reasonable limit of its technical development and while the territory which it served was still far from saturation, these increasing costs were largely offset by improvements in apparatus and methods. In fact, there are many instances where in spite of these conditions net earnings, because of especially favorable local conditions, showed annual increases. Electric production units were each year becoming larger and more efficient. The art of distribution and transmission was making great strides. The investment per unit of capacity generally tended downward. At the same time the demand for utility service was growing, and what fifteen years ago was considered a luxury in a short time became a necessity. As long as this condition was present the economies growing out of increased efficiency and service development tended to offset the rise in labor and material prices, but when relatively high efficiency had been realized and the increases in the price level appeared to be gaining in momentum, the trend of net earnings in most instances turned definitely downward. With the reasonable limit of expansion reached, the crisis in the history of the utility industry approached. Between the pressure of increasing costs and the declining purchasing power of the dollar of income net earnings were threatened with extinction. This, in brief, was the condition of the utility industry when in 1914 the storm of the European war burst on the world—a war which each year has enveloped additional peoples and has gained in fury and destructiveness. And with the coming of this war the level of prices, which was already at the highest point reached in a generation, turned abruptly and violently upward, which tendency it has maintained to this time.

COMMODITY PRICES THAT GO BACK A HUNDRED YEARS

The diagram reproduced with this article shows Sauerbeck's ten-year average index prices for the years from 1817 to 1916, on which I have superimposed the annual index prices of the London *Statist* in order to show what has taken place beyond the period covered by the Sauerbeck data and what the extension of the Sauerbeck data for the next few years will reveal.

Just as the political history of the nineteenth century dates from the Congress of Vienna and the final

defeat of Napoleon, so the economic history of that century also begins with the conditions then broadly recorded. The year 1815 is one of those years in history which marks an epoch and the influences of which time extend for many decades. In the next few years we are likely to witness another such epoch-making date, when the world, bled white by war, will close a chapter of great social and economic forces in conflict, in the soil of which mighty political movements will have taken root.

Let me call attention to the fact that from the high-price level following the Napoleonic wars to the high level of the Civil War period was approximately fifty years. Also, following the low point reached in about 1846, it was again fifty years before the low level after the civil war was reached. Singularly, it is now just fifty years since the high level of prices in the Civil War period. In view of these events of the last century, covering two complete major economic cycles, in each case growing out of conditions similar to those with which the world is confronted at this time, can it be expected that following the declaration of peace in this war we shall see a quick decline in prices to the pre-war level or lower?

PREVAILING PROSPERITY IS LARGELY FALLACIOUS

In spite of prevailing conditions, we appear very prosperous at this time, but let us not be deceived. This is a war prosperity, and both England and Germany report the same kind of business activity. However, in view of what we know of conditions, it would be more correct to say that we are extremely busy rather than extremely prosperous, since we are not creating wealth. Our country, along with almost the entire world, is just now engaged under pressure of the greatest necessity in carrying on campaigns which are exhausting the man power and wealth of the world and from which all will emerge as peoples much poorer than before they entered. From this period of intense activity, of strained production and increasing consumption, we shall enter a period after the war when this destruction must be paid for by the hard labor and economies of the people. The reaction will be as great as was the action, but it will be extended over a much longer period of time. This does not mean that we shall at once have a serious depression. On the contrary, the necessity for urgent reconstruction and the accumulation of deferred work, together with the sentimental effect of the return of peace, will lead to considerable activity for a year or more after the close of the war; but the period of readjustment and of producing from the soil and other natural resources and by hard labor the wealth to pay for these struggles will cover many years, and during this time we shall undoubtedly experience a relatively high level of prices, but with a gradually declining tendency the world over.

Not only has our supply of gold been showing expanding tendencies, but our currency legislation for a number of years has operated to increase the supply of money and credits. Our currency laws, our Federal Reserve banking system, farm loan banks and the war credit machinery all operate strongly to encourage expansion which may even lead to inflation. These conditions will exert a powerful tendency to maintain prices at a high level and will offset many other influences which would otherwise operate for a decline. It is even possible that the government will find it to the interest of the country at large to give stability to the price movement and to prevent any violent decline.

Based on the course of the price movement after periods of great world wars in the past and in view of the special conditions with respect to the currency and banking systems at the present time, we may look forward to a considerable period of high prices, a period of business readjustment and a period of new social legislation. What this means in its full significance to individuals, to business in general, and especially to public utilities, can be readily understood without attempt on my part either to generalize or to go into details.

However, reflect on what it will mean to business to be required to make extensions and to finance requirements on this level of prices while operating under a rate schedule determined five years ago if we should not return for fifteen or twenty years to the price level on which such rate schedule was based. What will it mean to business to have to purchase operating supplies on the price level of five years ago? The price level under which plants were built, under which franchise obligations were established and on which rate schedules were established may not again be reached in fifteen years or even longer. There are some who say that prices will decline quickly with the return of peace. Whether they will or not no one definitely knows, but when we stop to consider the extent and destructiveness of this world-wide war and remember the price movement after each of the other two great wars, it is not difficult to believe that many men in this room will not live to see the return to the price level of 1914.

As a result of this violent price movement which we are now witnessing the work of the utility commissions has not only been enormously increased but the character of their decisions reflects the really constructive purpose of such institutions. During the decade of commission activity extending from 1907 to 1917 the almost universal results of commission investigations were reductions in rates. For the larger part of this period the rise in prices was gradual but extremely moderate in comparison with the last two years; but these increases were in many instances offset by the increased efficiency in utility operations and the great extension in service. So elastic was the industry and so quick its response to reasonable rate reduction that these years, which represent an almost unbroken record of rate reductions, at the same time mark the golden years of utility growth—years during which public utilities reached a point of growth in size and stability comparing favorably with the greatest industries of history.

At the present time, however, the commissions, which were quick to take advantage for the public of every economy in operation or profit resulting from improvements, are now foremost in granting relief from the pressure of high prices. Nearly five hundred public utilities have received increases in rates or have been relieved from burdensome obligations by state utility commissions and by city councils within the last fifteen months, and among this number are companies operating in many of the large centers of population. If the present tendency among state commissions and city councils to permit increases in rates to offset rising costs continues, the year 1918 will witness a practical

cancellation of much of the work for rate reduction accomplished by these same authorities after many years of labor. It will also show that the original conception of a public utility commission as a continuing investigating body created to do justice to investor and public alike was correct, and that even in the midst of this great war, wherein every element of our national life is strained to the utmost, the desire for justice and fair play to all interests is still firmly grounded in the heart and mind of the great American public.

Standing out among the problems now before these commissions and growing out of the rapid increase in commodity prices are two facts which should be developed and properly presented to the regulatory authorities, the justice and necessity of which are apparent from a study of the price movement. These are, first, the necessity of departing from the use of the five-year and ten-year average prices as a basis for rate-making appraisals and, secondly, the necessity for a larger return on the fair value of the property.

Zone System for Bituminous Coal

Change in the Plan of Distribution Made by the Fuel Administration with the Intent of Reducing the Burden on the Railroads, Facilitating Shipment of Fuel and Keeping All Mines Working at Their Full Capacity

IN ORDER to reduce the burden on the railroads by the elimination of cross-hauling and the curtailment of railroad equipment in unnecessarily long hauls, the United States Fuel Administration in conjunction with the Director General of Railroads has devised a zone system for the control of bituminous-coal distribution for the year beginning April 1, 1918. Hereafter no cars or locomotives will be engaged in delivering coal to distant regions that can be served far more quickly from fields near by.

As shown by the map accompanying this article, the country is divided into a number of zones each of which will be supplied with coal from mines relatively near, thereby preventing abnormal and wasteful transportation movements and insuring more equal distribution of cars to the mines and more steady employment of mine labor. For example, Pocahontas coal will no longer find its way to Chicago and other Illinois points, but these latter will be compelled to substitute coal which can be obtained from Illinois mines with half as long a haul. Obviously, where the fuels possess different characteristics changes in boiler settings and methods of firing may have to be made. It is the hope of the Fuel Administrator, however, that unavoidable inconveniences will be borne gladly in view of the fact that the readjustment of the distribution of coal is made for the welfare of the nation.

The zone system does not affect bituminous coal for railroads, bituminous coal for movement on inland waterways or coal delivered to Canada. Moreover, there are certain exceptions to the conditions imposed. Where certain industries require coal of particular quality or characteristics, if that coal is not obtainable from the district in which the plant is situated, permits will be granted to bring in the fuel from other districts.

The zones are clearly indicated on the accompanying map and are marked with a key number. Definite boundaries are fixed for the zones such as state lines or railroad lines. A complete list of all the zones shown in the map is given in the key, which also enumerates the districts from which coal may be obtained. If, for instance, a consumer wishes to ascertain what coals are available for his use, he locates on the map the zone in which his plant is situated and notes its number. Under that zone number in the "Key to Consuming Zones" is given the list of producing districts from which coal can be had. A wall map of large size showing the same zoning in fuller detail may be obtained from the Coal Zone Map Company, Glen Echo, Md.

KEY TO CONSUMING ZONES

Zone Number	Restricted to Coals Indicated
1	North Dakota, South Dakota, docks.
2	Illinois (summer only), docks, North Dakota, South Dakota, Iowa, (to points in Iowa only).
3	Illinois, Kentucky (Western), Indiana, docks.
4	Illinois, Kentucky (Western), docks.
4A	Illinois, docks.
5	Iowa, Kansas, Illinois, Missouri, Oklahoma, Arkansas.
6	Illinois, Kentucky (Western).
6A	Illinois, Kentucky (Western), docks.
7	Illinois, Iowa (to points in Iowa only).
8	Illinois, Indiana.
9	Illinois, Indiana, Kentucky (Western).
10	Indiana, Illinois (Danville district on Wabash Ry. only), Kentucky (Western, to Jeffersonville and New Albany only).
11	Virginia (L. & N. R. R.), Tennessee (M. R. R.), West Virginia (Southern), Illinois, Indiana, Kentucky (Eastern and Western).
12	Indiana, Illinois (Danville district on Wabash Ry. only).
13	Kentucky (Western).
14	Indiana, Kentucky (Eastern), West Virginia (Northern and Southern), Virginia (L. & N.), Tennessee (M. R. R.), Michigan, Ohio (on G. R. & I. Ry. only).
15	Illinois, Indiana, Kentucky (Eastern and Western), West Virginia (Northern and Southern), Virginia (L. & N.), Tennessee (M. R. R.), Michigan.
16	Indiana, Illinois (Danville district on Wabash Ry. only), Kentucky (Eastern), West Virginia (Southern).
17	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern).
18	Virginia (L. & N. R. R.), Kentucky (Southern), Tennessee (M. R. R.).
19	Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern, also Eastern, to points on C. & O. Ry. from Catlettsburg, Ky., to Cincinnati, Ohio).
20	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Northern and Southern), Indiana, Illinois (Danville district on Wabash Ry. to points in Indiana only), Ohio, Michigan.
21	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Northern and Southern), Ohio, Michigan.
22	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern), Ohio.

KEY TO CONSUMING ZONES (*Continued*)

Zone Number	Restricted to Coals Indicated
23	Kentucky (Northeastern), West Virginia (Northern and Southern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
24	Kentucky (Northeastern), West Virginia (Southern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
25	West Virginia (Northern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
26	Ohio.
27	Pennsylvania, Ohio.
28	No change contemplated in this plant except that low-volatile coal in the Pocahontas, Tug River and New River districts on the N. & W. R. R. and the C. & O. Ry. and the Virginian Ry., and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. R. R., also high-volatile east of Charleston, W. Va., on C. & O. Ry. and east of Iaeger, W. Va., on N. & W. R. R., will be restricted to the District of Columbia (except C. & O. Ry.), Virginia (including tide-water terminals), also points in West Virginia on the direct line of the C. & O. Ry. and N. & W. R. R. east and west bound and Virginia Ry. east bound.
29	Ohio, West Virginia (Northern, also Eastern, to points on the direct lines of the C. & O. Ry. and N. & W. Ry.).
30	No change.
31	North Dakota, Wyoming, Montana and other fields east of the Rocky Mountains, docks.
32	North Dakota, South Dakota, Wyoming, Montana, docks.
33	South Dakota, Wyoming, Montana and other fields east of the Rocky Mountains, North Dakota, docks.
34	North Dakota, South Dakota, Wyoming, Montana, Illinois (summer), docks.
35	Iowa, Kansas, Missouri, Arkansas, Oklahoma, Colorado and other fields east of the Rocky Mountains, Wyoming.
36	Kansas, Missouri, Iowa, Arkansas, Oklahoma, Colorado (Southern).
37	Oklahoma, Missouri, Arkansas, Kansas, Colorado, New Mexico, Texas.
38	New Mexico, Colorado, Texas.
39	Colorado, New Mexico, Arkansas, Oklahoma, Texas.
40	Kentucky (Western), Alabama, Texas.
41	Arkansas, Illinois (summer), Iowa, Kansas, Missouri, Oklahoma, docks.
42	Arkansas, Iowa, Kansas, Missouri, Oklahoma.
43	Iowa, Arkansas, Kansas, Missouri, Oklahoma.
44	Arkansas, Illinois, Kansas, Missouri, Oklahoma, Texas.
45	Alabama, Arkansas, Illinois (only on lines of St. L. S. W. Ry. and St. L., I. M. & S. Ry.), Kansas, Missouri, Oklahoma, Kentucky (Western), Texas.
46	Alabama, Arkansas, Illinois (only on lines of St. L. S. W. Ry. and St. L., I. M. & S. Ry.), Kentucky (Western), Texas.
47	Kentucky (Western).
48	Alabama.
49	Alabama, Kentucky (Western).
50	Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Kentucky (Western), Tennessee, Georgia.
51	Alabama, Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee, Georgia.
52	Alabama.
53	Kentucky (Southern, also Western, to points on N., C. & St. L. and T. C. R. R., Nashville to Old Hickory and Hermitage, Tenn., inclusive), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise, and western Russell Counties of Virginia, also Clinch Valley district in eastern Russell and Tazewell Counties), West Virginia (Eastern, also Southern, on C. & O. Ry. east of Charleston and N. & W. Ry. east of Iaeger, W. Va.), Georgia, Tennessee.
54	Kentucky (Southern), Tennessee, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Alabama, Georgia.
55	Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee, Georgia, West Virginia (Eastern).
56	Kentucky (Southern), Tennessee, Virginia (all Black Mountain and Stonega Districts in Lee, Dickenson, Wise and western Russell Counties of Virginia, and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. Ry.), West Virginia (Eastern, on C. & O. Ry. and N. & W. Ry. and Virginian Ry.).
57	No change contemplated. Coal to be supplied generally from low-volatile fields.

EXPLANATION OF TERMS USED

Summer	From April 1 to and including Sept. 30.
Winter	From Oct. 1 to and including March 31.
KENTUCKY	
Eastern	All mines in eastern Kentucky on Sou. Ry. (Q. & C.), L. & N., C. & O., N. & W. and L. F.
Northeastern	Sandy Valley & Elkhorn Ry., L. F., C. & O. and N. & W. in Thacker, Big Sandy and Elkhorn districts.
Northern	L. & N. in Hazard and Elkhorn districts.
Southern	Sou. Ry. (Q. & C.) and L. & N. in Harlan, Jellico and Southern Appalachian districts.
Western	L. & N. and I. C. west of Louisville, Ky.
WEST VIRGINIA	
Eastern	C. & O. and N. & W. in low-volatile fields of Pocahontas, Tug River and New River districts.
Northern	K. & M., K. & W. V. and C. & C. west of Dundon.
Southern	C. & O. and N. & W. in Kanawha, Kenova and Thacker districts.

KEY TO PRODUCING DISTRICTS

Location of District	Numbers of Consuming Zone to Which Restricted
Alabama	40, 45, 46, 48, 49, 51, 52, 54.
Arkansas	5, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46.
California	30.
Colorado	30, 31, 33, 35, 36, 37, 38, 39.
Docks[1]	1, 2, 3, 4, 4A, 6A, 31, 32, 33, 34. 41.
Georgia	50, 51, 53, 54, 55.
Illinois (summer)	2, 34, 41.
Illinois	3, 4, 4A, 5, 6, 6A, 7, 8, 9, 10[3], 11, 12[3], 15, 16[3], 20[3], 44, 45[3], 46[3].
Indiana	3, 8, 9, 10, 11, 12, 14, 15, 16, 20.
Iowa	2[4], 5, 7[4], 35, 36, 41, 42, 43.
Kansas	5, 35, 36, 37, 41, 42, 43, 44, 45.
Kentucky:	
Eastern	11, 14, 15, 16, 17, 19, 20, 21, 22.
Northeastern	23, 24.
Southern	18, 50, 51, 53, 54, 55, 56.
Western	3, 4, 6, 6A, 9, 10, 11, 13, 15, 40, 45, 46, 47, 49, 50, 53[5].
Maryland	57.
Michigan	14, 15, 20, 21.
Missouri	5, 35, 36, 37, 41, 42, 43, 44, 45.
Montana	30, 31, 32, 33, 34, 35.
New Mexico	30, 35, 37, 38, 39.
North Dakota	1, 2, 31, 32, 33, 34.
Ohio	14[6], 20, 21, 22, 23, 24, 25, 26, 27, 28[7], 29.
Oklahoma	5, 35, 36, 37, 39, 41, 42, 43, 44, 45.
Oregon	30.
Pennsylvania	27, 28, 57.
South Dakota	1, 2, 32, 33, 34.
Tennessee (M. R. R.)	11, 14, 15, 17, 18, 19, 20, 21, 22.
Tennessee	50, 51, 53, 54, 55, 56.
Texas	37, 38, 39, 40, 44, 45, 46.
Utah	30, 31, 33, 35, 36.
Virginia (L. & N.)	11, 14, 15, 17, 18, 20, 21, 22.
Virginia[8]	50, 51, 53, 54, 55, 56.
Virginia[9]	53, 56.
West Virginia:	
Eastern	19, 23[10], 24[10], 25[10], 29[10], 53, 55, 56.
Northern	14, 15, 20, 21, 23, 25, 29.
Southern	11, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 53.
Wyoming	30, 31, 32, 33, 34, 35.

[1]South bank Lake Superior and west bank Lake Michigan.
[2]From Danville district on Wabash Ry. only.
[3]Only on lines of St. L., I. M. & S. and St. L. S. W. Rys.
[4]To points in Iowa only.
[5]To points on N., C. & St. L. and T. C., Nashville to Hermitage and Old Hickory, Tenn., inclusive.
[6]On G. R. & I. only.
[7]From mines in Columbiana County, Ohio, only.
[8]All Black Mountain and Stonega districts in Lee, Wise, Dickenson and western Russell Counties.
[9]Clinch Valley districts in Tazewell and eastern Russell Counties.
[10]Along lines of C. & O. and N. & W. to Cincinnati and Columbus, Ohio.

Sudden Short Circuits of Alternators

Thorough and Critical Exposition of Electromagnetic Phenomena Attending Sudden Short Circuits of Alternators in the Light of Recent Experimental Results—Practical Methods of Calculating Characteristics

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IN THIS article it is proposed to give a thorough, complete and the simplest possible exposition of the electromagnetic actions which take place when an alternator, or a system connected to it, is suddenly short-circuited. At the outset the author does not hesitate to state that the article is non-mathematical. However, it must be conceded that in engineering the most useful and practical knowledge is the quantitative knowledge; thus an attempt will be made to serve the

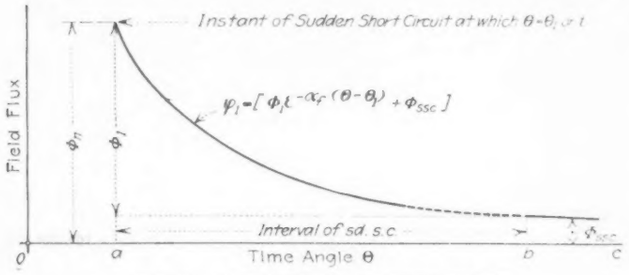


FIG. 1—ATTENUATION OF FIELD FLUX

majority who may desire only qualitative information without neglecting the minority who can use only quantitative knowledge.

It is apparently the opinion of some engineers that "an exact solution of the problem seems quite impossible," or that "it is well nigh impossible to estimate with a reasonable degree of accuracy the rate of decay of the current."[1] However, the writer is inclined to believe that with a thorough and clear understanding of the electromagnetic phenomena involved in the sudden short-circuit[2] of alternators, and through the proper interpretation and check of the theories proposed, it will be possible to solve and answer many practical problems and questions.

ANALYSIS OF THE ELECTROMAGNETIC PHENOMENA

To establish a concrete basis from which to work consider an n-phase, non-salient pole alternator operating light at full speed and normal excitation. Before the occurrence of a sudden short circuit the field mmf., acting alone, produces a certain flux $\Phi_{normal} = \Phi_n$ which links with the armature. If the machine is suddenly short-circuited, there is a great rush of current which sets up enormous stresses varying as the square of the current. This is followed (in about one or two to seven seconds in case of turbo-alternators without and with external reactors) by the "steady" condition of sustained short circuit,[3] in which the strong demagnetizing armature currents combine with the field mmf. to produce the resultant flux, $\Phi_{ssc} = \Phi_{sustained\ sh.\ circ.}$ It is well known that Φ_{ssc} is a small fraction of Φ_n; thus the flux in the machine, somehow or other, dies down from Φ_n to Φ_{ssc}. E. J. Berg, to whom this theory is due, assumes that the flux decays according to the attenuation factor of the field in the manner indicated in Fig. 1.

Under sustained short-circuit or normal operation the armature conductors cutting the constant fluxes Φ_{ssc} and Φ_n produce an alternating emf., say sinusoidal in shape as indicated in Figs. 2a and 2b, where the maximum values E_{ssc} and E_1 are proportional to Φ_{ssc} and Φ_n respectively. The transient or decaying flux which lasts during the interval ab (Fig. 1) produces an emf. as illustrated in Fig. 2c, where E_1 is proportional to $(\Phi_n - \Phi_{ssc})$, and the rate of decay is assumed to depend upon α_f, the attenuation factor of the field.

Knowing the quantitative expressions for the emf. acting under sudden short circuit and the sustained short circuit, it is a simple matter to find the current due to them. According to Kirchhoff's second law, the sum of the emfs. e_1 and e_{ssc} (see Fig. 2, page 1029) is equal at every instant to the sum of the armature resistance and reactance drops. The equivalent mathematical expression which involves r_a and x_a, the armature resistance and reactance per phase, and also α_a and α_f reduces to

$$i_a = I_{ssc}\left[\left(k\frac{X}{Z}\right)\varepsilon^{-\alpha_f(\theta-\theta_1)}\sin(\theta-\beta) + \sin(\theta-\beta_1) - \varepsilon^{-\alpha_a(\theta-\theta_1)} \times \left\{k\frac{X}{Z}\sin(\theta_1-\beta) + \sin(\theta_1-\beta_1)\right\}\right] \quad (1)$$

Where I_{ssc} = the ssc, armature current = (E_{ssc}/z_a); $(E_1/z_a) = (kE_{ssc}/x_a)$; or $E_1 = kE_{ssc}$; $z_a = \sqrt{r_a^2 + x_a^2}$ = armature impedance; $\alpha_a = (r_a/x_a)$ = armature attenuation factor; $R/X = (\alpha_a - \alpha_f)$. $Z = \sqrt{R^2 + X^2}$; $\beta = \tan^{-1}(X/R)$; $\beta_1 = \tan^{-1}(x_a/r_a)$. Equation (1) may be simplified by assuming $\beta = \beta_1 = 90$ deg.[4] Until it is known exactly what these quantities stand for and what the assumptions involved are, however, mathematics will only shield ignorance. Considering the complexity of the subject, however, it will be best, before taking up its physical interpretation, to look at the problem from another viewpoint based on the excellent work of P. Boucherot.[5]

THREE-PHASE SUDDEN SHORT CIRCUITS

Consider one of the phases of a three-phase alternator and suppose that phase No. 1 is at the position indicated in Fig. 3, when the three phases are suddenly and simultaneously short-circuited. Assuming a sinu-

[1] See, for example, *Transactions A. I. E. E.*, Vol. 34, 1915, p. 2275; also the *Electrician*, London, August, 1906, p. 765, etc.

[2] Where referred to by symbols it is indicated by *sd. s. c.*

[3] Where referred to by symbols it is indicated by *ssc.*

[4] See Berg's "First Course in Electrical Engineering," p. 301.

[5] *Transactions International Electrical Congress*, 1911, Turin, Italy; also, *Bulletin Société Internationale des Electriciens*, Paris, December, 1911.

soidal flux distribution, the flux inclosed by phase No. 1 at the instant of the short circuit will be:

$$N_a\Phi_a\sin\omega t_1 = N_a\Phi_a\sin\theta_1$$

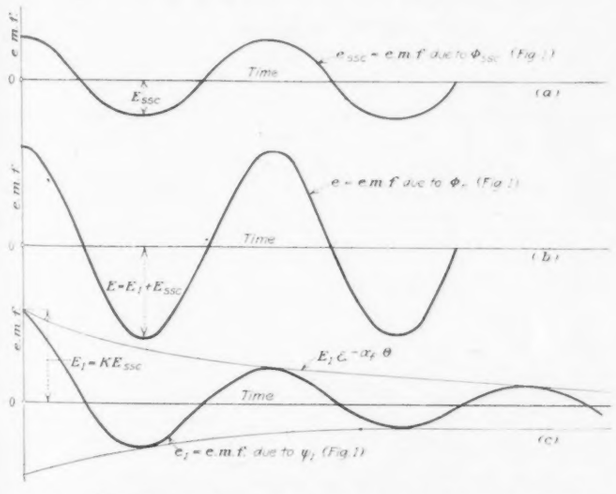
where $N_a\Phi_a$ = maximum flux inclosed by the N_a turns of any given phase. The flux inclosed by phase No. 2 at the instant of the sudden short circuit will be $N_a\Phi_a\sin(\theta_1 + 2\pi/3)$, and similarly for the third phase.

As is well known, the flux inclosed by any given phase under sustained short circuit is a very small fraction of $N_a\Phi_a$. Therefore, if it is assumed[6] that the sustained short-circuit armature reaction (*a*) is wholly demagnetizing (*b*) and sinusoidally distributed like the field flux, and that (*c*) the armature resistance drop is negligible compared to the reactance drop; then a little consideration will show that the armature flux under sustained short circuit will be zero. Thus the flux linking with phase No. 1 is $N_a\Phi_a\sin\theta_1$, at the instant of the sudden short circuit when $t = t_1$; it is reduced to zero at the end of the short circuit when $t = \infty$, and it is $(N_a\Phi_a\sin\omega t)\,\varepsilon^{-\alpha_a(t-t_1)}$ at any time t during the interval of sudden short circuit, α_a being the attenuation factor of the armature. Under normal or transient conditions the flux linking phase No. 1 is equal at every instant to the mutually inductive flux coming from the field plus the self-inductive flux of phase No. 1 itself. The corresponding condition holds true for the other phases.

The field flux, which is $N_f\Phi_f$ under normal conditions, dies down to Φ_{fssc} at the end of the sudden short circuit or at the beginning of the sustained short circuit; at any time after the sudden short circuit it is equal to

$$\Phi_f = \Phi_{fssc} + (\Phi_f - \Phi_{fssc})\,\varepsilon^{-\alpha_f(t-t_1)}$$

where α_f is the attenuation factor of the field. Under normal or transient conditions this flux is equal at every instant to the mutually inductive flux coming from the three phases plus the self-inductive flux of the field itself.



FIGS. 2a, 2b AND 2c—EMFS. PRODUCED BY CONDUCTORS CUTTING Φ_{ssc}, Φ_n AND $(\Phi_n - \Phi_{ssc})$

Having the fundamental sudden short-circuit equations, the next step is to solve them for the field and armature currents. The procedure followed by Boucherot (see footnote 5) is rather long and involves some almost "formidable mathematics." He obtains approximate *theoretical* expressions (Table I) for the damping factors α_f and α_a in terms of L_a, λ_a, L_f and λ_f (L is self-inductance and λ leakage inductance), for single-phase and two-phase short circuits, when the machine is equipped with perfect or ideal amortisseur windings and when it is not. Substituting in these the experimental values of L_a, λ_a, L_f and λ_f given in Table II, columns 4 and 5 are obtained. From these it is seen that the theoretical effect of amortisseur windings is to increase the damping factor of the armature about 33 per cent and that of the field about 16 per cent. This, of course, is very beneficial, especially from the point of view of the circuit-opening devices.

Interesting as these results may be, it seems to the writer that it is well at present not to rely too much on these theoretical or ideal results. This attitude seems justifiable in the light of some extensive sudden-short-circuit tests made several years ago by C. M. Davis[7], which indicate that the "amortisseur winding has little or no influence." However, it may be added here that the experience of some operating companies seems to be contrary to this.

If instead of getting α_f and α_a mathematically, they are obtained experimentally by means of the rise of direct current[8] in the armature and field respectively or by some other method[9], expressions can be readily obtained for the transient armature and field currents. The sudden-short-circuit field current of a three-phase alternator is given by

$$i_f = I_f[1 + D\varepsilon^{-\alpha_f(\theta-\theta_1)} - D\varepsilon^{-\alpha_a(\theta-\theta_1)}\cos(\theta-\theta_1)] \qquad (2)$$

where I_f = permanent field current, i_f = transient field current, $\theta = \omega t$, $D = (L_f - \lambda_f)/\lambda_f = (L_a - \lambda_a)/\lambda_a$; α_a and α_f are the attenuation factors of the armature and the field. The armature current for phase No. 1 is:

$$i_1 = I_{ssc}\left[(\cos\theta_1)\left(1+\frac{D}{2}\right)\varepsilon^{-\alpha_a(\theta-\theta_1)} - \cos\theta - (D\cos\theta)\right.$$
$$\left.\varepsilon^{-\alpha_f(\theta-\theta_1)} + \frac{D}{2}\left(\cos(2\theta-\theta_1)\right)\varepsilon^{-\alpha_a(\theta-\theta_1)}\right] \qquad (3)$$

and the currents i_2 and i_3 for the other phases are similar except that instead of (θ and θ_1) the expressions $(\theta - 2\pi/3)$, $(\theta_1 - 2\pi/3)$, $(\theta - 4\pi/3)$ and $(\theta - 4\pi/3)$ are used respectively.

CRITICAL ANALYSIS OF THE EQUATIONS

In framing the theory of sudden short circuit and deriving quantitative expressions for the field and armature currents certain assumptions have been made or, strictly speaking, an *ideal* alternator has been considered having sinusoidal flux distributions, constant resistances, reactances, etc. However, all these equations and definitions of r_a, λ_a, α_a, etc., apply to ordinary commercial machines, in so far as they approximate the ideal machine for which all the theories in general are made. Thus it should be clear that the resistances r_f and r_a are not the ohmic or direct-current resistances

[6] (*a*) assumes the angle $\Psi = 90$ deg. Assumptions (*a*) and (*c*) are ordinarily quite permissible, but the second assumption as to the distribution of armature reaction is very far from being true according to extensive investigations some of the results of which will be presented shortly before the A. I. E. E. Still, (*b*) may be taken as a permissible assumption, as far as theory is concerned, in order to simplify matters.

[7] *General Electric Review*, August, 1914, p. 816.

[8] See *Transactions A. I. E. E.*, Vol. 34, 1915, p. 2244, Section II.

[9] See *Transactions A. I. E. E.*, Vol. 34, p. 2260, and p. 2266, Sections IV and VII. See also second installment of this article.

of the field and armature conductors, but they are the alternating-current resistances corresponding to the actual non-uniform flux distribution under short-circuit conditions. Furthermore, it may be easily seen that the different quantities r, L, λ, etc., are and have to be assumed as constant, though actually they are neither constant nor is the law according to which they

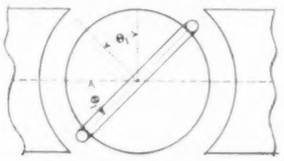


FIG. 3—CONDITION ASSUMED FOR DISCUSSION STARTED AT BOTTOM OF PAGE 1028

vary usually known. It is fortunate, however, that, as experience indicates, satisfactory results can be obtained by using certain average values or by introducing certain empirical or semi-empirical factors.[10]

The extent to which the preceding theory can be applied to actual machines may be answered qualitatively as follows: Consider, for example, the damping factor of the field, $\alpha_f = r_f/x_f$; here r_f is not the direct-current resistance of the field spools but it includes any eddy-current or energy-consuming effects which help to damp out the field transients. Furthermore, as just stated, the reactances and even the resistances involved in (2), (3), etc., do not remain invariable during the short circuit. In fact, the writer has noticed that the damping factors are considerably and consistently[11] larger during the first cycle or so of the sudden short circuit than toward the end of it. This is especially true of α_f, which has high values at first and then remains constant for the rest of the sudden short circuit. For example,[12] in case of a 700-kva., 4000-volt, 60-cycle machine the following values were obtained from a sudden-short-circuit oscillogram:

$\epsilon^{2\pi\alpha_f} = 1.127$, or $\alpha_f = 0.019$ for first two cycles.
$\epsilon^{2\pi\alpha_f} = 1.039$, or $\alpha_f = 0.0061$ for succeeding five cycles.
$\epsilon^{2\pi\alpha_f} = 1.065$, or $\alpha_f = 0.10$ mean for all seven cycles.

Similarly,

$\epsilon^{2\pi\alpha_a} = 1.426$, or $\alpha_a = 0.0564$ for first two cycles.
$\epsilon^{2\pi\alpha_a} = 1.575$, or $\alpha_a = 0.0722$ for succeeding five cycles.
$\epsilon^{2\pi\alpha_a} = 1.532$, or $\alpha_a = 0.0677$ mean for all seven cycles.

A quantitative answer, however, to the question is extremely difficult, since so much depends upon the flux distribution, the flux oscillations and the eddy-current paths in the pole faces, the armature teeth, etc. Furthermore, a great deal depends upon the design and construction details of a given machine or a given type of machine. For example, it is conceded that the sudden short circuit of large turbo-alternators having a cylindrical field of two or four poles is very much more serious than that of salient-pole alternators. However, the writer knows of cases where salient-pole alternators with a comparatively large number of poles had a ratio of sudden-short-circuit current to full-load current 20 to 40 per cent higher than large turbo-generators five to ten times the kva. rating of the salient-pole machines. Fortunately, here, as in many engineering problems, a definite quantitative answer is not necessary, and it is safe to state that at present, guided by the rational theories developed above, the sudden-short-circuit characteristics of a machine or a system can be calculated with the accuracy required in ordinary practice, in most cases and for most problems, without subjecting the machine to unreasonably dangerous or expensive tests.

PHYSICAL INTERPRETATION[13] OF SUDDEN-SHORT-CIRCUIT PHENOMENA

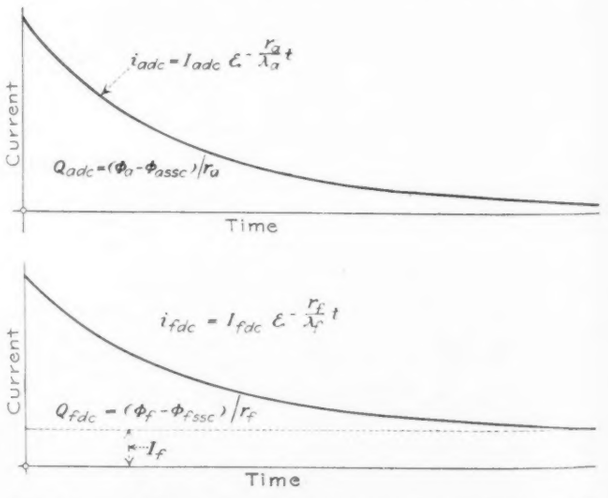
This has really, explicitly or implicitly, been given in the foregoing quantitative exposition. Still, it may be well to consider further some of the physical aspects of the subject, which is admittedly very complex. To begin with, it is known that:

(a) The comparatively large flux existing under normal operating conditions is reduced to practically zero under sustained short circuit.

(b) The rate of decay in mutually inductive circuits depends upon the total or equivalent leakage inductance and not the inductance L.[14]

(c) The fundamental fact true of any electromagnetic circuit, that any change of the flux inclosed by a circuit gives rise to, and is equal to, a quantity of electricity q times the total resistance of the circuit.[15]

Upon these fundamentals are based the most important interactions between the armature and field during sudden short circuit. In Fig. 4, Q_{adc} represents the quantity of electricity due to the change of flux in the phase under consideration. This quantity gives rise to i_{adc} in the armature, and it is clear that its value depends upon the amount of flux inclosed by the phase at the instant of sudden short circuit; *i.e.*, $Q_{adc} = (N_a\Phi_a\sin\theta_1)/r_a$. It is a maximum when $\theta_1 = 90$ deg. or when the emf. wave is zero, and it is zero when



FIGS. 4a AND 4b—QUANTITY OF ELECTRICITY DUE TO CHANGE OF FLUX IN ARM..TURE AND FIELD CIRCUITS

[10]These remarks apply to standard theories of all alternating-current or direct-current machines.

[11]See *Transactions A. I. E. E.*, Vol. 34, 1915, p. 2266, where attention was called to this.

[12]Based on data given in *General Electric Review*, February, 1917, p. 125, Table I. The method of calculation of α_a and α_f is described later in this article.

[13]See footnote, page 11.

[14]Throughout this article the definitions of L, λ and M given before are strictly adhered to.

[15]A method based on this principle is used to determine the apparent resistance of a ballistic galvanometer on closed circuit. The method consists in connecting the galvanometer to a secondary whose primary is supplied with direct current. From the deflections of the galvanometer for different resistances of the secondary the apparent resistance of the instrument can be calculated, or if desired the mutual inductance of the two circuits may also be obtained.

$\theta_1 = 0$ or the emf. is maximum. Similarly $Q_{fdc} = (\Phi_f - \Phi_{fssc})/r_f$ is due to the change of flux in the field and gives rise to i_{fdc} (in the field). This, of course, is independent of θ_1 or the point of the emf. wave at which the short circuit occurs.

Referring to the equations, it will be found that in case of the armature current:

The first term in (3) and the third term in (1) represent i_{adc} of Fig. 4a, and according to either term

TABLE I—THEORETICAL ATTENUATION FACTORS WITH VALUES FROM TABLE II SUBSTITUTED TO GIVE COLUMNS 4 AND 5

Kind of Sudden Short Circuit	Theoretical Attenuation Factors Derived Mathematically		Column 2 in per Cent of (r_f/L_f)	Column 3 in per Cent of (r_a/L_a)	Field Equipped or Not with Perfect Amortisseur
	α_f of the Field	α_a of the Armature	Based on Experimental Results Given in Table II		
(1)	(2)	(3)	(4)	(5)	(6)
Two-phase	$\left(\frac{r_f}{\lambda_f}\right)^*$	$\frac{r_a}{L_a}\left(\frac{D}{2}+1\right)^{**}$	$3.04\left(\frac{r_f}{L_f}\right)$	$1.50\left(\frac{r_a}{L_a}\right)$	Not equipped
Two-phase	$\left(\frac{r_f}{\lambda_f}\right)$	$\left(\frac{r_a}{\lambda_a}\right)$	$3.04\left(\frac{r_f}{L_f}\right)$	$2.01\left(\frac{r_a}{L_a}\right)$	Equipped
Single-phase	$\frac{r_f}{\sqrt{L_f \lambda_f}}$	$\frac{r_a}{\sqrt{L_a \lambda_a}}$	$1.74\left(\frac{r_f}{L_f}\right)$	$1.41\left(\frac{r_a}{L_a}\right)$	Not equipped
Single-phase	$\frac{r_f}{L_f}\left(\frac{D}{2}+1\right)^{**}$	$\frac{r_a}{\lambda_a}$	$2.02\left(\frac{r_f}{L_f}\right)$	$2.01\left(\frac{r_a}{L_a}\right)$	Equipped

*λ = Leakage inductance. **$D = (L_f - \lambda_f)/\lambda_f = (L_a - \lambda_a)/\lambda_a$.

i_{adc} is a decaying direct current and is a function of θ_1 as just explained.

The second term in (3) and the second term in (1) represent the sustained short-circuit armature current due to Φ_{fssc}, Fig. 2a.

The third term in (3) and the first term in (1) represent the decaying alternating current due to i_{fdc} induced in the field, Fig. 4b.

In the case of the field current:

The first term in (2) represents the steady direct-current exciting current.

The second term in (2) represents i_{fdc} of Fig. 4b, due to the change of flux in the field.

The third term in (2) represents an alternating decaying current induced in the field by the decaying direct current i_{adc} in the armature (see Fig. 4a).

There is a fourth term in (3) which represents a double frequency current in the armature decaying according to α_a. A little consideration will show that this is due to the alternating current in the field, which is of fundamental frequency and decays according to α_a, as indicated by the third term of (2). If all the interactions between the field and armature were to be taken into account, it would be found that:

1. The direct-current decaying current in the armature represented by Fig. 4a and third term of equation (1) or first term of (3) produces an alternating current of fundamental frequency in the field, represented by the third term of (2).

2. This decaying alternating current in the field induces a double-frequency decaying current in the armature as represented by the fourth term of (3).

3. The decaying double-frequency current in the armature produces a triple-frequency decaying alternating current in the field, etc.

Hence there may be the second, fourth, sixth, etc., even harmonics in the armature and the first, third, fifth, etc., odd harmonics in the field, all decaying according to the armature damping factor α_a. Besides the above harmonics, due to i_{adc}, it can be shown that unbalanced three-phase currents in case of an unbalanced sudden short circuit or balanced three-phase odd harmonics of the armature current will produce armature reactions of double, quadruple, sextuple, etc., frequency, which in turn will produce emfs. and currents of third, fifth, seventh, etc., frequency in the armature. However, experience shows that in most practical cases the higher harmonics in the field and armature may without important consequence be neglected.[16]

TABLE II—ATTENUATION FACTORS* OF THE FIELD AND ARMATURE OF ONE MACHINE AS OBTAINED FROM THE RISE OF DIRECT CURRENT IN THE FIELD AND ARMATURE RESPECTIVELY

Test No.	Manner in Which Field or Armature Were Connected	Machine at Rest or Running	Attenuation Factors			Inductance in per Cent	
			Of Field α_f in per Cent	Of Armature			
				α_a in per Cent	Actual Values	Field	Armature
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	Armature open circuit	At rest	100	....	....	100	....
II	Armature dead short circuit	At rest	107	....	....	93	....
III	High R across armature	Full speed	117	....	....	85	....
IV	Armature dead short circuit	Full speed	304	....	....	33	....
V	Field open circuit	At rest	....	100	0.070	...	100
VI	Field dead short circuit	At rest	....	139	0.097	...	72
VII	Field open circuit	Near. full speed	....	185	0.130	...	54
VIII	Field dead short circuit	Full speed	....	201	0.140	...	50

Transactions A. I. E. E., Sept., 1915, p. 2271.

Wireless Signal Lamp for War Work

Engineers of the National Lamp Works of the General Electric Company, working in conjunction with experts from the federal ordnance department, have developed a wireless signal lamp for airplane service and other war work. It can be flashed at a great distance by means of energy transmitted to it through wireless extensions now in use. The advantage of this lamp is in the elimination of wires which can be cut or tampered with by the enemy. It can be used between stations on the ground at the battle front or between ground stations and airplanes flying over the enemy's territory. To John Randall, advisory head of the lamp department at Nela Park, credit is given for the development of the lamp. He has spent years in experimental work with lamps.

It is stated that an absorbent gas for use in fighting poisonous gases thrown by the enemy is being perfected at Nela Park.

[16] See also the ELECTRICAL WORLD, Dec. 29, 1917, p. 1251, where by means of curves and oscillograms the interactions between field and armature are illustrated and their combined effect in producing the complex transient field and armature currents is explained qualitatively or non-mathematically.

Experience with Powdered Coal

Fuel in This Form Considered Especially Desirable as Low-Grade Coal Can Be Burned at High Efficiency—Method of Preparing and Burning Fuel—Results of Tests

BY A. E. MACINNIS

WITH the experience of the past winter in mind and the possibility of a worse fuel scarcity and the new problems imposed by the recent order of the Fuel Administration regarding zone distribution ahead, every coal-consuming plant will do well to ascertain what methods are being employed to burn coal more economically, especially the lower grades. Experience in the Northwest may shed some light on the subject, and for this reason a brief account of the situation there and of what is being done to improve it will be given in this article.

More than a year ago the price of fuel oil began to advance rapidly, and there was a prospect that crude oil might be withdrawn from the market. This caused an increased demand for coal, which threatened to overtax the mine and transportation facilities. Three possible ways of meeting this situation were considered—first, utilizing grades and kinds of coal previously wasted; second, securing higher efficiency from the coal burned; third, substituting wood to make up the shortage.

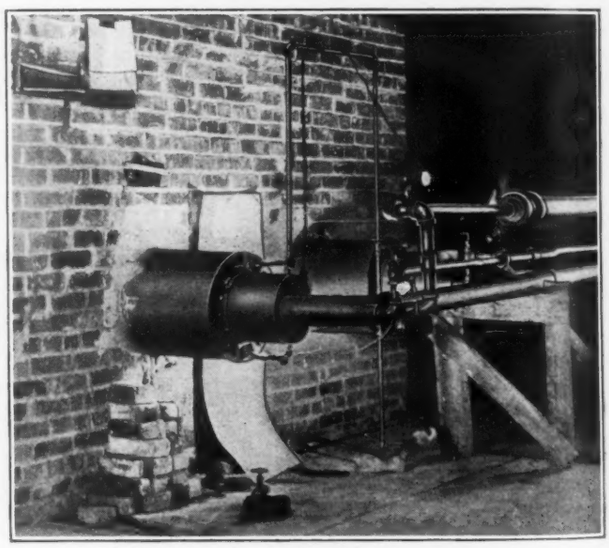
One of the first men in the Northwest to attempt the solution of the fuel problem was W. J. Santmyer, advisory engineer and superintendent of steam heat for the Puget Sound Traction, Light & Power Company, Seattle. From previous experiments he was inclined to favor pulverized coal, as by its use low grades of coal can be burned at relatively high efficiency. In theory this form of combustion is ideal since it provides an intimate, even and thorough mixture of coal and air, which allows complete combustion with a minimum of excess air. On Mr. Santmyer's recommendation the company conducted a series of experiments* with powdered coal in a 300-hp. Babcock & Wilcox boiler which lasted from February to June. The results obtained were so favorable that the company authorized the erection of a complete pulverized coal plant for ten boilers, aggregating 4100 boiler-hp. This installation is now in progress, but before describing the new plant a résumé of the experiments will be given.

PREPARATION OF THE COAL

The powdered coal was prepared at the briquetting plant of the Pacific Coast Coal Company, about 12 miles (19.3 km.) from Seattle. This plant is in continual operation, its boilers and driers being fired with its own pulverized coal. The preparation process is as follows: If not already to size, the coal is crushed to ¾ in. (19 mm.) and then fed into a Ruggles drier, which consists of two nearly horizontal steel cylinders, one within the other. The furnace is installed at the higher end, and the hot gases pass through the inner cylinder to the lower end and then back between the two shells in contact with the coal. Both cylinders rotate slowly so that the coal is continually agitated as it passes down to the lower end of the drier. Drying of the coal is necessary to prevent cohesion of the particles which would interfere with pulverization. The degree of drying necessary varies according to the form in which the moisture occurs in the coal, ranging from 1 to 6 per cent.

The grinding is done in a Raymond mill. The degree of fineness necessary is that which will allow complete combustion while the fuel is still suspended. With lignites having a high volatile content and ash with a high fusing point coarser pulverization is permissible than with coals having a greater proportion of fixed carbon. With the local coal available the best results are obtained when 95 per cent will pass through a 100-mesh screen and 85 per cent through a 200-mesh screen.

The powdered coal was transported to Seattle in a box car equipped with a metal-lined hopper, so as to be air-tight and prevent the absorption of moisture. From this it was discharged into an inclosed conveyor which elevated and dumped it into the bunker. The coal was fed into the boiler supply pipes by two motor-driven screws and conveyed about 30 ft. (9.1 m.) horizontally to the boiler front by compressed air.



APPARATUS THROUGH WHICH POWDERED COAL IS DISCHARGED INTO FURNACE

As it is imperative that there be sufficient space in the furnace for complete combustion to take place without contact with the boiler tubes and to avoid damage to the brickwork due to the blasting effect of the flame, an extended or "Dutch" oven was built out about 5 ft. (1.5 m.) in front of the boiler. After considerable experimenting Mr. Santmyer devised a burner and feeder that gave a thorough mixture of coal and air and just the discharge velocity to keep the fuel suspended until completely burned.

It was found that certain coals would slag at com-

*See ELECTRICAL WORLD, June 9, 1917, p. 1105.

paratively low temperatures, but by constructing a slag pit underneath the furnace with sides sloping sharply away from the top opening it was found that the slag would drop off in small chunks which could be readily removed through a clean-out door.

Boiler trial records were kept of fifteen test runs made with many different kinds of coal, among which

TABLE I—TEST OF 300-HP. B. & W. BOILER BURNING FOUR GRADES OF POWDERED COAL (See Table II)

	A	B	C	D
Elapsed time (hr., min.)	14-30	12-30	21-30	14-38
Water by Venturi meter (lb.)	156,000	177,800	179,500	169,500
Temperature of water (deg. Fahr.)	186	190	192	186
Water evaporated, actual (lb.)	153,600	175,000	176,630	166,960
Temperature of steam (deg. Fahr.)	407	405	401	408
Steam pressure, gage (lb.)	110	106	108	116
Temperature corresponding to pressure (deg. Fahr.)	344	332	343	347
Superheat (deg. Fahr.)	63	73	58	61
Factor of evaporation	1.1	1.1	1.09	1.1
Weight of coal (lb.)	21,220	22,020	22,980	21,820
Evaporation per pound of coal, as fired from and at 212 deg. Fahr.	7.24 8.0	7.95 8.77	7.68 8.37	7.64 8.42
Draft in uptake, in inches water	0.27	0.35	0.31	0.27
CO_2 (per cent)		13	13	13½
B.t.u. per pound of coal, dry powdered	10,000	11,368	10,985	10,967
B.t.u. per pound of coal, raw	8,677	.....	9,952	9,449
Efficiency (per cent)	77	75	74	75
Kind of coal	New-castle*	Newcastle	Mendota mine run	Renton buckwheat

*Under water for several years.

were South Prairie, Black Diamond, Renton, including sludge, which in raw state analyzed over 21 per cent ash and 30 per cent moisture; Tono, which runs only about 8000 B.t.u.'s per pound; Newcastle screenings, which had lain for years under water in Lake Washington; Mendota; Nanaimo (B. C.) slack, and coal from Rock Creek, Cal. The results of some representative tests are given in Table I.

The experiments indicated the following advantages for pulverized coal:

Different kinds and grades of coal can be prepared, transported, stored and burned with the same equipment without physical difficulty.

Higher efficiency can be obtained than with any other means of combustion.

Powdered coal is not (contrary to a rather prevalent opinion) dangerous to handle.

Low-grade coals that cannot be burned efficiently in any other manner give good results in the powdered form.

The powdered-coal fire is easy to operate and dependable. It is smokeless, even under heavy overload. It is remarkably flexible, it having been possible to force the 300-hp. boiler to 600 boiler-hp. in a few minutes without injury to the heating surface or brickwork.

The increased capacity of boilers means less investment and hence a saving through lower fixed charges additional to that due to greater efficiency.

Because of these advantages the company decided to change its Western Avenue station to a powdered-coal plant. Before describing this installation, the writer wishes to impress on the reader that it is not being pointed out as necessarily the best installation. To his knowledge, however, it is the *first* large stationary boiler plant to be operated on powdered coal as a commercial undertaking. Because it is a pioneer in this field it does warrant particular notice. At present it is only in the course of construction and will likely not be ready to try out until August and not in full operation until Sept. 1. Therefore comment on its efficiency, cost and in general its success must be delayed until a demonstration is made under actual operating conditions.

DESCRIPTION OF POWDERED-COAL PLANT

Raw coal will be delivered over the company's street-car tracks and dumped into a 500-ton bunker across the street from the station. This bunker can be enlarged to 1500 tons capacity. The coal will pass through a single-roll crusher rated at 75 tons per hour, which will reduce the coal to 1-in. (2.54-cm.) size, if not already of that fineness. A belt conveyor will carry the coal under the street to a 300-ton raw-coal bunker in the station. From this bunker the coal will pass over an apron conveyor, designed to empty the storage bin completely into either or both of the two Fuller driers. The driers have a capacity of 15 tons per hour each, are 55 ft. (16.8 m.) long and consist of single-shell steel cylinders, one 5 ft. (1.5 m.) in diameter and the other 6 ft. (1.8 m.). A brick furnace covers more than half the shell, firing being accomplished from the side. Powdered coal will be used for firing both driers in burners designed by Mr. Santmyer.

The dry coal will be elevated in buckets to a bin holding 100 tons, from which it will be fed by gravity onto an apron conveyor leading to four Fuller pulverizers. Each of these mills measures 42 in. (106 cm.) and is designed to grind 5 tons of coal per hour fine enough so that 95 per cent will pass through a 100-

TABLE II—COAL ANALYSIS (IN PERCENTAGE)

	Newcastle Coal*, Raw		Newcastle Coal*, Drier		Newcastle Coal*, Powdered		Mendota, Mine Run		Renton Buckwheat			Newcastle	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	Raw	Dry Powdered	Raw	Drier	Powdered	Powdered as Fired	Dry Bins
Water	14.22	.....	2.80	.....	3.04	.....	21.85	7.50	15.20	7.11	5.44	4.43	.....
Volatile	38.54	44.92	41.01	42.19	42.04	43.35	34.38	43.88	39.14	42.68	45.32	42.09	44.04
Fixed carbon	34.17	39.83	42.20	43.41	39.26	40.49	32.50	37.13	32.10	37.32	35.57	40.55	42.42
Ash	13.07	15.23	13.99	14.39	15.66	16.15	11.80	11.49	13.56	12.89	13.67	12.93	13.53
Total	100.00	98.00	100.00	99.00	100.00	99.00	100.53	100.00	100.00	100.00	100.00	100.00	99.00
Sulphur	0.03	0.46	0.38	0.40	0.37	0.40	.....	.....	0.37	0.42	0.39	0.34	0.36
B.t.u.	9,952	11,602	11,515	11,847	10,985	11,329	.....	.....	9,449	10,862	10,967	11,368	11,895

*Years under water.

mesh screen and 85 per cent through a 200-mesh screen. In this type of mill the grinding is done by large cast-iron balls propelled around a race so as to press the coal against a wearing ring.

From the mills screw conveyors will carry the coal to a bucket conveyor, which will elevate it to the top of the building and deliver it into other screw conveyors that will take it to the steel bins over the front of each boiler. These bins will hold 15 tons each and will drop the powdered coal in front of the boilers, where it will be picked up by air at perhaps 6 oz. (26 gm. per cm.) pressure and carried to the bunker. This air will be furnished by two centrifugal fans, one on each side of the boiler room, driven by steam turbines exhausting into the steam heating mains.

Of the ten boilers, four are to be rated at 300 boiler-hp., three at 400 hp., one at 500 hp. and two at 600 hp. In the 300-hp. and 400-hp. boilers two burners will be used and in the larger boilers three burners. Three different burners will be tried out—Santmyer's, Muhlfield's and Fuller's. Mr. Santmyer's feeder and burner will be similar to that which gave good results in the experiments referred to before.

All the boilers will be equipped with Dutch ovens extending 5 ft. (1.5 m.) out in front, stretching the full width of the boiler, and standing 7 ft. (2.1 m.) high. Each boiler will also have a slag pit underneath. The slag pits will be of different design, according to the requirements of the feeder and burner, but each pit will have a clean-out door for the removal of slag.

Other Powdered Coal Developments

In addition to the Briquetteville plant the Pacific Coast Coal Company has powdered coal plants operating successfully at both its Black Diamond and Newcastle mines. At Black Diamond there are two 300-hp. Wickes water tubular boilers and ten 150-hp. horizontal return-tubular boilers, all fired by burners and feeders designed by Messrs. Santmyer and Ralph Galt. The coal is dried in a 10-ton Ruggles drier, fired with powdered coal and pulverized in a 5-ton Raymond mill. The unique thing with this installation is the absence of slag pits. The size of the boiler plant being sufficient to avoid forcing the boilers beyond 125 per cent rating, the furnace temperatures are low enough to prevent slagging.

The Newcastle plant is practically a duplicate of that at Black Diamond except that there a Fulton mill does the grinding instead of a Raymond.

In Seattle Messrs. Santmyer and Galt are changing the oil-burning plant in the Crystal Pool natatorium to powdered coal. The same boiler setting will be used without a slag pit as the two 150-hp. horizontal return-tubular boilers will make enough steam without undue forcing. A 10-ton steel bunker is being built to receive the powdered coal from a specially constructed auto truck which will haul the prepared coal from the Pacific Coast Coal Company's plant at Briquetteville.

As the Western Avenue plant will be the first large station to use powdered coal, so the Crystal Pool will be the first small isolated plant to burn pulverized fuel, delivered by auto truck. Should the actual results realize the expectations based on the experiments already made, present methods of burning low-grade coal will be altered considerably.

A WAR-TIME EXPEDIENT AND MEASURE OF ECONOMY

Growth of Load Cared for by Means of Change from Two-Phase to Three-Phase Four-Wire —Considerations That Governed

BY H. C. DEAN
General Superintendent New York & Queens Electric Light & Power Company

TO PROVIDE for growth in load the New York & Queens Electric Light & Power Company, Long Island City, N. Y., was confronted, not long ago, with the problem of increasing the rating of its distribution circuits about 30 per cent. In some districts it was possible to postpone the installation of additional copper in the feeders and obtain the increase merely by replacing 100-amp. regulators in the substations with 150-amp. or 200-amp. regulators. In the case of the Long Island City district, however, the current-carrying capacity of both feeders and regulators had been reached, and all regulators were of the maximum size (200 amp.) which the company considers it desirable to use.

Choice of Systems

Three methods of solving the problem were open: (1) To install additional two-phase feeders (2300 volts, four-wire; (2) to install high-tension feeders and relieve the 2300-volt feeders of the larger consumers; (3) to change the 2300-volt, two-phase system to 2300/4000-Y volts, three-phase.

The chief question at first was whether or not it would be as cheap to change from two-phase to three-phase as to leave the two-phase system and transfer the larger consumers to lines operating at transmission voltage. A number of consumers are so supplied at the present time, and the company is looking forward to increasing such services to a large extent from now on. With the existing geographical layout of the lines and large consumers, the arguments were two to one in favor of changing the two-phase distribution system. However, this was due to local conditions, and it is possible that for other companies the advantages would be materially different, either greater or less.

Careful estimates showed that the third alternative would provide the necessary rating for less than half the expenditure required by the other methods, owing chiefly to the high cost of copper. It had the additional advantage that any future feeders would have 50 per cent greater capacity as three-phase feeders than as two-phase feeders, while the per cent line loss and voltage drop would be only half as great. To determine the relative advantages of three-phase over two-phase, it was therefore only necessary to determine the valuation of the existing distribution system (less the poles) and to balance 50 per cent of this cost against the cost necessary to change to three-phase.

In the Long Island City district the power load is about four times as large as the lighting load, consequently considerable work had to be done in making changes in the transformer banks. Although new consumers are provided with three-phase service, it was decided to continue two-phase, 230-volt service to existing consumers. This made it necessary to replace one transformer of each power bank with two of half the rating having 10 per cent taps. The connections and

the voltages obtained are shown in the accompanying diagram. There are no theoretical disadvantages in this method, as far as the writer can see, and it has given entire satisfaction for the past seven months.

METHOD OF MAKING CHANGE-OVER

To facilitate the work on the day when each feeder had to be changed from two-phase to three-phase

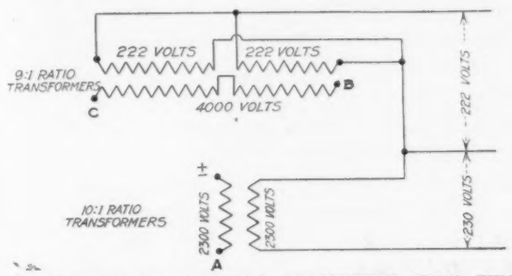


FIG. 1—METHOD OF SECURING CONVERTING FROM TWO TO THREE-PHASE WITH STANDARD TRANSFORMER

(which in every case was Sunday), the replacement of one transformer in each power bank with two of half capacity was made in advance, the two smaller transformers being connected in multiple temporarily. The testing of all underground 2300-volt services, the replacement of certain cable not safe enough for operation at 4000 volts, and the installation of pot-heads on all cable ends, constituted the only other preliminary work on the feeders themselves.

In the substation it was necessary to install a spare panel complete with equipment and three regulators for a three-phase feeder and to provide for maintaining one of the 2300-volt buses at three-phase. This spare panel and equipment was used for the first feeder changed over to three-phase, which thus released a two-phase panel and the corresponding equip-

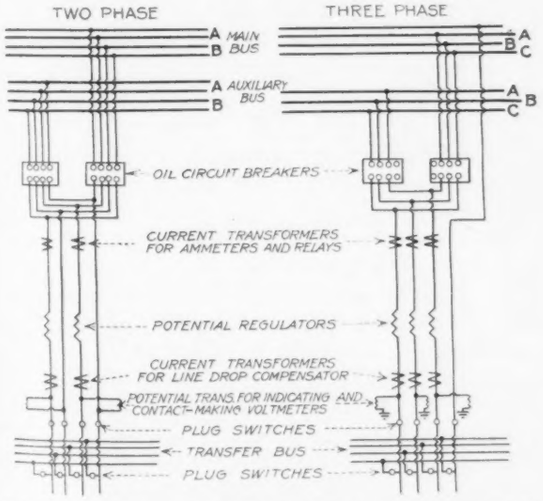


FIG. 2—METHOD OF ARRANGING FOR CHANGE-OVER FROM TWO-PHASE TO THREE-PHASE

ment. The panel in turn was built over to provide for the second three-phase feeder, etc.

On the day of actual change-over of a feeder it was only necessary to change the connections of certain transformers and to transfer the feeder connections from the two-phase bus to the three-phase bus. Any power consumer who had to have service Sunday morning was permitted to use it until noon, by which time the fuse plugs of all power transformers were disconnected. The feeder was then switched from the two-phase bus to the three-phase bus and the power consumers were given service in the order of their needs. The change did not require rearrangement of the overhead circuits.

ECONOMIC ADVANTAGES

The change from two-phase to three-phase distribution in Long Island City district has resulted in a decided war economy, since it has made unnecessary the installation of additional two-phase feeders, the expense of which would have been five times the cost of making the feeder changes to obtain three-phase. Furthermore, it has decreased the line losses by approximately 200 kw., which alone would pay interest charges on the cost of making the change. In addition, it has improved the voltage regulation 100 per cent, which means that better service is given and that loads at great distances from the substation can be more economically handled than heretofore, thereby delaying the day when additional substations may be required.

The company is now planning to change over the distribution system in the rest of its territory, which lies in the borough of Queens, comprising over one-third of the area of New York City. The population served is small compared with Manhattan's, but is about equal to that of Minneapolis.

The borough of Queens, which covers 117 square miles (30,000 hectares) of territory on Long Island, is considered to be growing more rapidly than any other section of New York City.

INTERNATIONAL TRADE-MARK REGISTRATION BEGINS IN CUBA

Bureau Opened at Havana as Result of Fourth Conference of American States at Buenos Aires in 1910

The International Trade Mark Bureau, for registration of trade marks of producers and manufacturers in the eleven northern countries of North America, Central America and the West Indies, has been opened at Havana, Cuba, under the direction of Dr. Mario Diaz Irizar, who will arrive in Washington shortly for conferences with United States Patent Office officials and the State Department, as a result of which regulations for the conduct of the bureau will be worked out. It may be decided to issue a monthly bulletin in English and Spanish, recording work of the bureau.

The Havana bureau and another to be opened at Rio de Janeiro result from the fourth conference of American states at Buenos Aires in 1910, at which an international trade-mark agreement was reached. The Rio de Janeiro bureau, which will provide for registration of trade-marks in the southern countries of South America, as the Havana bureau does for the northern countries, cannot be opened until three more countries have ratified the 1910 agreement at Buenos Aires. It was provided that two-thirds of the countries involved must ratify. Of the ten countries in South America only four—Brazil, Ecuador, Paraguay and Bolivia—have ratified so far. It is expected that some time during the coming year Peru will ratify and that eventually other South American countries will do so.

Great Electrical War Convention in California

Central Stations, Manufacturers, Jobbers, Contractors and Dealers Discuss War Problems at the Annual Convention of the Pacific Coast N. E. L. A. Section—Co-operation of the Industries

WAR problems were the chief topics discussed by representatives of all branches of the electrical industry at Del Monte, Cal., last week. In session with the annual convention of the Pacific Coast Section of the National Electric Light Association were the Pacific division of the Electrical Supply Jobbers' Association, the California Association of Electrical Contractors and Dealers, manufacturers' representatives and others, totaling more than 400 delegates. Even more than in the case of previous California conventions was this gathering notable for the variety of interests represented and the spirit of co-operation manifest. The advantage was not only in promoting closer relations and better understanding, but also in expediting action on matters where conference and agreement between the several branches of the industry were required.

President H. F. Jackson, Sierra & San Francisco Power Company, opened the meeting Thursday morning with a patriotic address, urging that all efforts be bent toward extending the usefulness of the electrical industry in war service and that closer co-operation in all branches be cultivated.

Thursday's Engineering Session

Thursday afternoon the engineering session was opened with J. E. Woodbridge, Sierra & San Francisco Power Company, in the chair. He reported that subcommittees working jointly with state and federal officials have rendered service in work on conservation and war measures.

F. D. Nims, Washington Coast Utilities, Seattle, and H. H. Schoolfield, Pacific Power & Light Company, represented the Northwestern Electric Light and Power Association. Mr. Nims said the use of powdered coal and sawmill refuse in the Northwest is helping to solve the fuel problem. Large industrial consumers have been induced to shift working hours so as to relieve peak conditions. Mr. Schoolfield described Portland's endeavor to conserve resources rather than energy and said that interconnection is receiving careful attention.

Fred H. Fowler, district engineer for the United States Forest Service, read a paper on the possibility of water-power development in California, Nevada, Arizona and New Mexico. The characteristics of the several drainage systems and their power sites were discussed and attention was directed to the large ratio of steam to water power. The small amount of hydroelectric development in recent years was noted and the need for a change in this regard was emphasized. Three prospective sources for increased power stand out, Mr. Fowler thought, as more notable than others in California. These are the Big Bend of the Pitt River, the combination of an increase in Great Western capacity on the Feather River with adjacent developments of the Pacific Gas & Electric Company, and the increase of capacity on the Big Creek system. On the Pitt River two alternatives are considered. One, promising 175,000 hp., would require a seven-mile (11.2-km.) tunnel, while the other, though of only about half the capacity, could be built in much less time. The Feather River project would afford about 195,000 hp. It involves two miles (3.2 km.) of tunnel. The Big Creek system could be increased about 300,000 hp. by adding to its drainage area. Because of the oil shortage and abundance of water power the electrification of mountain divisions of the railroads was urged. With the railroads now using three times as much oil as the next largest consumer, electrification must be studied in a new light.

Other papers presented at this session were: "Power Resources in Southern California," by H. A. Barre, Southern California Edison Company, and "Joint Operation of Power Companies," by J. P. Jollyman, Pacific Gas & Electric Company, San Francisco.

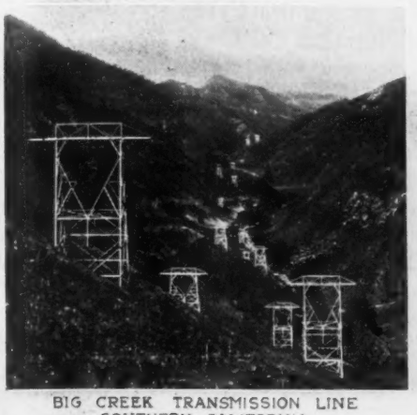
Government Announces Its Fuel-Oil Plan

D. M. Folsom of the Pacific Coast Petroleum Administration announced by letter that fuel-oil users will be listed and classified probably within six months, and only those industries entitled to priority rating will be allowed to have oil. Public utilities will receive such rating only where industries served are entitled to priority, and the burden of proof of such priority shall rest upon the power companies. The oil supply will be exhausted within a year at the present rate, Mr. Folsom said, even with great economy. Drilling operations this year thus far show a 40 per cent decline as compared with last year.

L. S. Ready, Railroad Commission of California, reviewed the progress made in interconnecting transmission systems, pointed out that the State is two or three years behind in its hydraulic development and suggested developing small additional sources of energy wherever possible rather than concentrating solely on larger developments.

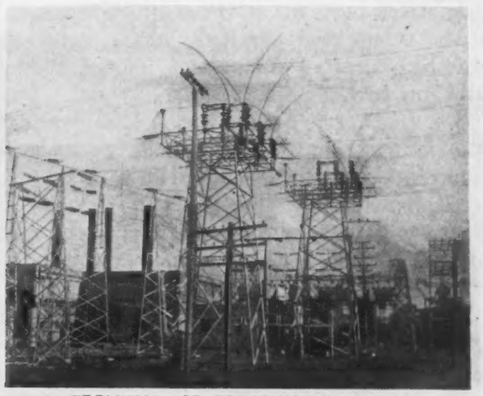
R. H. Ballard, Southern California Edison Company, suggested the desirability of securing financial aid from the War Finance Corporation in developing needed hydroelectric power. Without some such plan financing on the large scale necessary would be impossible. Prospects for such aid are improved by the amount of energy used on the Pacific Coast for irrigation pumping, because of the 800,000-hp. shortage on the Atlantic Coast found by the War Industries Board, and because of the extent to which hydroelectric development will release oil for the navy and the merchant marine.

P. M. Downing, Pacific Gas & Electric Company, said that the chief problem is how to finance the additional hydroelectric development which is urgently needed. With the completion of interconnections now under way the available energy will be utilized. This means that when the curtailment of oil comes load must be correspondingly dropped. John Hood, General Electric Company, San Francisco, drew a parallel between the unpreparedness of this country at the outbreak of the war and the present lack of definite plans

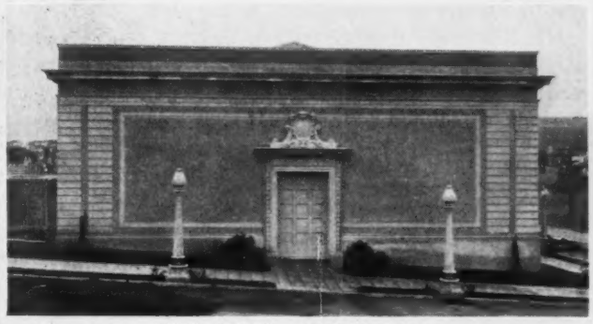


BIG CREEK TRANSMISSION LINE
SOUTHERN CALIFORNIA

STANISLAUS HYDROELECTRIC
STATION, SIERRA & SAN FRANCISCO
POWER CO.



TERMINAL OF TRANSMISSION LINE,
SOUTHERN SIERRAS POWER CO.

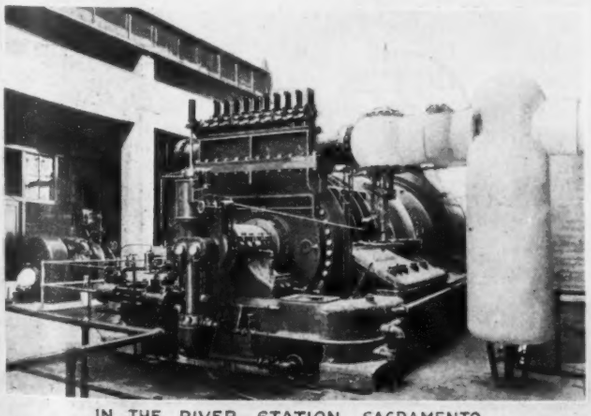


ATTRACTIVE SUBSTATION
PACIFIC GAS & ELECTRIC CO.

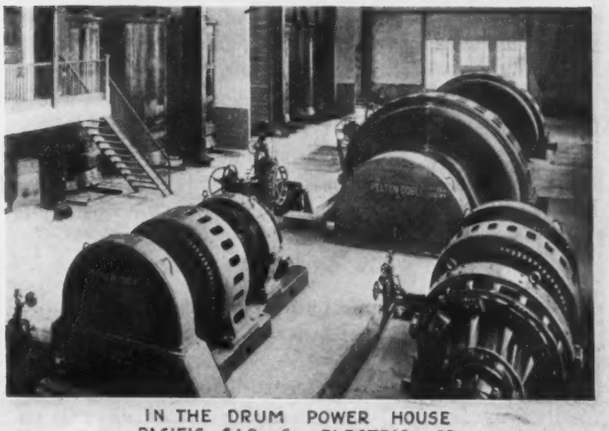
DEL MONTE HOTEL,
WHERE THE CONVENTION WAS HELD

SWITCHES AT SOUTH TOWER, CARQUINEZ STRAIT CROSSING,
PACIFIC GAS & ELECTRIC CO.

PACIFIC GAS & ELECTRIC SUBSTATION AT
BERKELEY



IN THE RIVER STATION, SACRAMENTO
PACIFIC GAS & ELECTRIC CO.



IN THE DRUM POWER HOUSE
PACIFIC GAS & ELECTRIC CO.

FEATURES OF CALIFORNIA ELECTRIC COMPANIES REPRESENTED AT CONVENTION

for electrifying mountain divisions. Because railroads are by far the largest consumers of oil and because locomotives burn oil at three times the rate normal in highly economical stations where equivalent energy could be generated preparation for electrification should be begun now.

S. J. Lisberger, Pacific Gas & Electric Company, San Francisco, stated that neither large hydroelectric developments nor electrification of railroads could be effected immediately and that our greatest problem is how to meet energy demands during the next eighteen months. To help in this he urged attention to the multitude of minor economies all can make, such as boiler-wall insulation, the use of economizers, efficient combustion and decreasing waste of energy at every point.

Mr. Barre stated that fuel consumption would always be necessary on electric generating systems. Not only is fuel properly used to carry peaks but it should also carry a part of the load in low-water years, thereby making economical larger hydroelectric installations. Two sources of electrical power in southern California can be made available very quickly, Mr. Barre stated. The Los Angeles Aqueduct can be made to produce annually an additional 100,000,000 kw.-hr., and the capacity of the Kern River plant No. 3 can be increased by 180,000,000 kw.-hr. These extensions would supply demand increases for about two years. The larger developments should also be begun now in order to be ready for further demand increases in two years.

Others who participated in the discussion were Max Thelen, president California Railroad Commission; C. O. Poole, Southern Sierras Power Company, Riverside; Edward Whaley, Northern California Power Company; W. M. Shepard, California-Oregon Power Company; E. A. Quinn, San Joaquin Light & Power Corporation, and E. R. Northmore, Los Angeles Gas & Electric Corporation.

Women's War Service Session

On Thursday evening a war service session was held for ladies of the convention. Mrs. H. F. Jackson effectively outlined the purpose of conferences of women of the electrical industry and the great possibilities they give.

Miss Gertrude Tucker, secretary to the president of the Southern California Edison Company, explained how women employees have come to be recognized as worthy of training such as that given to the men, holding that the modern woman has genuine service ideals and a stronger spirit of loyalty than the men. Women employees in her company have increased from 50 to 250 and the employment of women station and switchboard operators is being contemplated.

Mrs. Frank A. Gibson spoke on the making of a loyal citizen, outlining work to be done for our foreign population.

Friday's Engineering Session

At the Friday morning engineering session economies in operation of generating and transmission systems were discussed.

J. A. Koontz, Great Western Power Company, San Francisco, maintained that wearing bands shrunk on waterwheel runners and scroll cases have greatly increased the life and efficiency of units. The efficiency of worn runners can sometimes be improved by electric welding, he said.

Mr. Nims reported increased efficiency by carefully keeping tailwater elevation at the lowest level consistent with the seal on the draft tube.

G. R. Milford, Northern California Power Company, San Francisco, reported relieving hammering and vibration in a draft tube by tapping a faucet into it and opening it slightly.

Mr. Schoolfield described a 1900-hp. plant installed to utilize power from a 60-ft. (18.2-m.) drop in a canal system previously wasted. This plant has an induction motor running as a generator. It is entirely automatic and has been running four years without trouble. Although it will not synchronize itself when relieved of load, a gate control scheme has been proposed for shutting off power until speed drops down to synchronism. At present an attendant must be sent to the plant to resynchronize it. It is thrown back on the system at 5 per cent under or over speed. Substation and line losses were discussed in detail.

Mr. Lisberger disapproved of keeping the rate of line transformer burn-outs too low. Higher economy is secured by working them well up to capacity, expecting to replace burn-outs occasionally.

L. M. Klauber, San Diego Consolidated Gas & Electric Company, reported over-all losses of 22 per cent. For the Southern Sierras system Mr. Poole reported over-all losses in stations and lines of about 37 per cent. Discussion on lower rates under less strict guarantees on continuity of service failed to develop a feasible plan.

Economies in the boiler room was a live topic. There was agreement that automatic burner and damper control afford important savings, but where men must control fuel feeding a bonus for economy was urged. Mr. Klauber described a home-made automatic steam-pressure regulator for oil burners. He has found automatic boiler tube cleaners or soot blowers to be so productive of higher efficiency as to rate them as a necessity. Under war conditions more frequent cleaning of oil burners, condensers and all apparatus subject to clogging was urged.

Mr. Lisberger described a home-made device used to determine salt content in boiler water. Where more than 50 grains per cubic centimeter is found a remedy is applied.

Mr. Nims reported that powdered coal is often of superior grade when made of a poor-grade coal. It was suggested that California poor-grade coal deposits might thus be utilized. R. S. Masson, Arizona Power Company, Prescott, reported that his company recently completed a steam plant which produced 354 kw.-hr. per barrel of oil under test or 1 kw.-hr. per pound of oil. The plant averages 256 kw. per barrel in monthly records. High economy is attributed largely to automatic control. The oil is the same used as elsewhere and under test showed 18,650 B.t.u. per pound.

Mr. Klauber spoke of increasing preference for steel over copper for conductors. His company has more than 300 miles (482.8 km.) of steel conductors in service. Even where salt spray strikes the lines double-galvanized cable is expected to last fifteen years. The economy is not only in the price but also in poles, for spans are doubled when steel replaces copper, and in reduced erection costs. Standard steel spans are 700 ft. (213 m.) for 40-ft. (12.9-m.) poles. Mr. Downing urged that, in buying insulators, in addition to specify-

ing line voltage the conditions to which the line will be subjected should be mentioned.

Confidence was expressed in the economy and safety of reinforced-concrete stubbing of decayed wood poles. A pole that would cost $50 to replace at present prices can be made safe in this way for less than $8.

COMMERCIAL SECTION MEETINGS

The Commercial Section convened on Friday morning, with Chairman R. M. Alvord, General Electric Company, presiding. The session was devoted chiefly to discussion on the general subject of retail selling practice. This brought out agreement that data on accounting methods in retail electrical stores must be collected for the use of the co-operative campaign committee. The percentage of gross income that should be used on advertising, for example, has been fairly well established in other lines of business, and such data in the retail electrical business are urgently needed. Discussion was taken part in by J. C. Rendler, Southern California Electrical Company; Glen Arbogast, F. E. Newberry Company, Los Angeles; H. L. Kimball, Oakland, and Louis Levy, Levy Electric Company, San Francisco.

At the Friday afternoon session a paper by Mr. Bibbins on development of the community of interest was fully discussed. Mr. Ballard urged endeavor toward improving public relations and interesting employees, consumers and the public generally in investing in utility securities. This, he held, is the most effective and complete answer to the municipal ownership tendency.

Much of the Commercial Section discussion dealt with ways and means of aiding the commercial co-operative campaign. It was decided that further meetings be held from time to time in various parts of the State to promote further co-operation on the part of all branches of the industry interested. W. L. Goodwin, General Electric Company, New York, outlined the Goodwin plan and explained its advantages. He dwelt particularly on the danger in the Western field of allowing sectional views and interests to hamper progress. The industry is too closely interrelated to permit of any but a national viewpoint.

John A. Britton, as chairman of the public policy committee, read a report summarizing the present position of the public utilities and reviewing some of their problems and progress toward still greater war service. A policy that would engender public confidence was urged, and the great need for passing the pending water-power laws was emphasized. Ample funds are in the banks for power development if the safety and profit of the investment are assured. Meantime, though no water power is being developed and fuel is scarce, energy demand is increasing in California at the rate of 10 per cent per year. The report concluded with a resolution that Congress be urged to pass legislation directed toward discontinuing the waste of water power so that fuel may be conserved. The convention adopted the resolution and ordered copies sent to all congressmen.

A resolution was also adopted instructing the incoming officers to appoint a bureau of publicity to the end that the daily press may properly report events in the electrical industry.

Among other resolutions adopted were those providing that effort be made toward Americanization of foreign-born residents, that endeavor be made to secure aid of governmental bureaus in providing sufficient energy for maintaining service to war industries, that further study and extension be made on interconnecting systems, that effort be made to conserve energy resources, that an effort be made to ascertain the amount of fuel oil available so that business of the companies may be adjusted accordingly, that the commercial co-operative campaign be extended for an additional six months, and that jobbers' and dealers' associations be invited to meet again with the Pacific Coast Section of the N. E. L. A.

ELECTION OF OFFICERS

Officers of the Pacific Coast Section, N. E. L. A., for the ensuing year were elected unanimously as follows: President, Samuel Kahn, Western States Gas & Electric Company, Stockton; vice-presidents, E. R. Davis, Southern California Edison Company, Los Angeles, and A. G. Wishon, San Joaquin Light & Power Company, Fresno; secretary, A. H. Halloran, *Journal of Electricity*, San Francisco; treasurer, J. F. Pollard, Sierra & San Francisco Power Company; executive committee, H. F. Jackson, H. A. Bostwick, J. B. Black, William Bauerhyte, George A. Campbell, D. E. Harris, Frank Somers, C. M. Einhart, S. Aller, H. E. Van Kuran, H. H. Jones and A. E. West.

JOBBERS' ASSOCIATION MEETING

The quarterly meeting of the Pacific division of the Electrical Supply Jobbers' Association was held at Del Monte just preceding the joint convention. Two open sessions were held, in which J. J. Gibson, Westinghouse Electric & Manufacturing Company, and W. L. Goodwin, General Electric Company, discussed laws for stabilizing trade conditions. Mr. Gibson had gone to the Pacific Coast from the East especially to discuss at this meeting his plan outlined in the March issue of *Electrical Merchandising*. The plan of basing discounts on each order on the quantity of that order was approved. The sense of the meeting was that, although adjustments must still be made, the Goodwin plan, which is the Pacific Coast plan, and the Gibson plan could be worked together. The next meeting of the jobbers' association was set for the middle of August at Paradise Valley, in Rainier National Park.

CONTRACTORS' AND DEALERS' MEETINGS

The California Association of Electrical Contractors and Dealers in its separate sessions decided unanimously to join the national association. Its sessions took on a broader tone because of the attendance of jobbers and manufacturers' representatives, who frequently participated. Two sessions devoted exclusively to the interests of motor men proved so helpful that a permanent motor section was proposed. Papers on motor sales were presented by F. W. Buzzell, San Francisco; C. E. Ingalls, San Francisco; H. H. Courtwright, Fresno, and E. Boyd, General Electric Company, San Francisco. The chief topics were the relations between manufacturer and agent and how to build up motor business.

In answer to the complaint that the motor business does not pay, Mr. Boyd affirmed that it does pay if properly managed. The study of motors, in order to analyze customers' needs and render service after the

sale, was urged upon dealers. The question of who is entitled to motor agencies was discussed at length, and all were in accord with the point that only those able to make sales intelligently and to render service should be so recognized. W. H. Gribble, Chico, suggested that one of the subjects of frequent controversy could be settled by making discounts only to motor agents.

Committees to Get Together

T. E. Bibbins, Pacific States Electric Company, San Francisco, urged that dealers get together and agree on improvements desired in the present plan. Manufacturers would welcome a uniform plan, he said, but while all sections of the Pacific Coast demand different action no changes whatever could be expected. These were the sentiments of the meeting. The dealers appointed a committee of three, and the manufacturers were asked also to appoint a representative committee in order that uniform plans might be agreed upon and steps taken to put them into effect.

The manufacturers' margin is small; so methods whereby the dealer can increase his profits on the present basis were considered. Study of the means of increasing rate of turnover and volume of business was suggested. Investigating the requirements in special lines, such as the printing trade, woodworking shops, etc., was advised. Purchasers will prefer dealing with local men rather than with manufacturers if the former render the desired service. Motors should not be sold to get wiring jobs, and the awarding of agencies to unscrupulous dealers was also condemned.

Chairman Frank J. Somers, San José, went on record as opposed to any more closed meetings of the association.

Among others who spoke were R. A. Balzari, Westinghouse company, San Francisco; W. S. Berry, Western Electric Company, San Francisco; A. J. Myers, Wagner Electric Company, San Francisco; P. H. Affolter, Garland-Affolter Engineering Company, San Francisco; F. S. Thomas, Valley Electrical Supply Company, Fresno; C. L. Lamoree, Westinghouse company, Los Angeles; C. F. Butte, Butte Engineering & Electric Company, San Francisco; C. S. Renwick, Richmond, and Frank E. Doerr, San José.

Entertainment Features

The joint entertainment features proved most effective in facilitating closer relationships, and at the Friday evening banquet a stirring patriotic address by Prof. Charles Mills Gayley, dean of the faculty of the University of California, brought home to all the importance of enlisting every resource and individual in win-the-war service.

Kingston, Jamaica, Reports Good Year

In the annual report of the West India Electric Company, Ltd., for the year ended Dec. 31, 1917, James Hutchinson, the president, says: "In consequence of a plentiful rainfall throughout the year the hydraulic station has been able to supply the necessary power for operating, with only occasional assistance from the auxiliary steam station; therefore the consumption of coal has been small. The company has been very fortunate in this respect during the last three years, especially as coal in Kingston has more than trebled in value."

Selling the War Savings Stamps as Steps Toward Liberty Bonds

NOTICE TO EMPLOYEES

We have no sympathy with workmen we have heard of who willfully slow down during regular working hours and days so as to make overtime necessary; and if any of these appear on our force they will be the first to get laid off. We are only too glad to pay tribute to all of our men who have worked for us steadily, and to say that no such criticism has ever been directed against them.

Sometimes, particularly on urgent work for the Government, overtime is absolutely necessary. If, under these circumstances, our employees earn overtime, we strongly urge them to put it, or in any event, a large part of it, into War Savings Stamps.

The virtues of W.S.S. are too well known to be dwelt upon here; but we remind you that every stamp you buy helps to shorten the war and is the safest and best way to save. When January 1, 1923, comes around, work may not be as plentiful as it now is, and you may be very glad to have War Savings Certificates to cash in.

You will find in each pay envelope a form to be filled out, indicating the amount of your pay you will be willing to take in war stamps, we having been appointed an authorized agent of the Treasury Department to sell stamps at cost.

F. W. LORD,
President.

"While a great many workmen may not be able to subscribe for Liberty bonds, there is no one who cannot buy war savings stamps," says F. W. Lord, president Lord Electric Company, New York. "In order to inculcate the thrift habit, we have caused this notice to be posted up wherever our men are at work.

"There is no question but that the war savings habit makes a strong and solid foundation for investments of the larger order, such as Liberty loan bonds, and we are encouraging all our workmen to save as much as they can afford, believing that it will not only be to their own benefit but to the benefit of the country."

WAR TENDENCIES NOTED BY UNDERWRITERS' LABORATORIES

Dana Pierce Speaks to Electric Club-Jovian League of Chicago on the Work of the Underwriters' Laboratories and the War

Speaking before the Electric Club-Jovian League of Chicago on May 9, Dana Pierce of the Underwriters' Laboratories, New York, told of the large amounts of wire and conduit which are being inspected by the regular forces of the laboratories, thus relieving, through systematized inspection, many men for other war work who would otherwise be required in an organization built up especially for such inspection purposes.

In commenting upon the tendencies which have been noted by the Underwriters' Laboratories in the development of electrical material during the war, Mr. Pierce stated that appliances to assure greater safety were decidedly in the ascendency. These are of two classes, namely, arrangements for grounding and arrangements for effecting inclosures of current-carrying parts. He dwelt at some length on the complications entering into problems of inclosing electrical equipment.

It was the prediction of Mr. Pierce that after the war there would be a marked advance in the field of electrical signaling growing out of work that has been done in the war. He also stated that there is at the present time a pressing need for the development of devices which will afford sightly, safe and inexpensive methods of extending light and power outlets from completed jobs. The now common flexible-cord method of carrying on this work met his severe criticism.

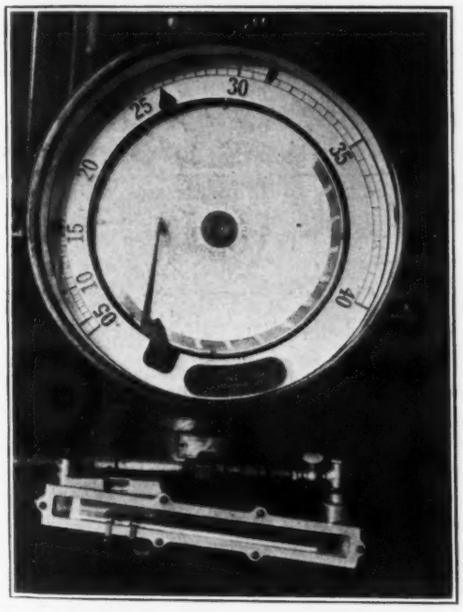
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPECIAL CALIBRATION OF STEAM-FLOW METERS

Full-Load, Load and One-Half and Double-Load Points for Units on Which Meters Are Used Are Shown by Red Markers

Additional markings are sometimes desirable on steam-flow meters used on individual boilers to indicate the full-load, load-and-one-half and double-load points. A meter calibrated in this manner is shown in the accompanying illustration, the points mentioned being indicated by pieces of red paper pasted on the white dial. They may be easily removed if desired.



100, 150 AND 200 PER CENT LOAD POINTS INDICATED ON SCALE

SHOP VERSUS FIELD TESTING OF NEW WATT-HOUR METERS

Minneapolis General Electric Company Favors Testing in the Field Exclusively—New Meters Are Set Without Testing After Rigid Inspection

Many central stations, according to George W. Hewitt, meter foreman of the Minneapolis General Electric Company, are actually wasting time and money testing new meters just received from the factory. Virtually all factories ship meters which are guaranteed to be accurate within 2 per cent. Testing the meters in the shop, carting them around all day in a vehicle, often installing them wrongly and not testing again for a year or so induces much "lost motion." "A shop test as compared with a service test, especially on direct-current meters, is not worth the money expended on it," says Mr. Hewitt.

In his opinion, the only test worth consideration is that made under actual service conditions. When the commutator of a direct-current meter, for instance, is polished and the meter adjusted it will be found that aging due to the oxidation of the silver commutator affects the meter and that a test made from thirty to sixty days after installation will show different results from a shop test or that made at the date of installation. Then, again, local and earth magnetic fields affect meters to a large extent, depending on the position of the meter. Errors of 5 to 10 per cent sometimes result from this cause.

The Minneapolis General Electric Company meter department does 90 per cent of its testing in service, holding its shop testing to a minimum. Meters which are repaired in the shop are adjusted within 2 per cent of complete accuracy, and new meters are not tested at all. They are thoroughly inspected and then tested within thirty days after the installation and adjusted to within 0.5 per cent of accuracy. The fact that 95.7 per cent of the installations tested are within the legal limit of 2.5 per cent accuracy seems to bear out the contention that this method of testing is satisfactory. According to the records, only eighteen meters out of 4309 recently installed failed to register. This plan of testing meters after installation has the further advantage of being a check on the men who install the meters.

FLEXIBLE DISTRIBUTION AS USED IN CLEVELAND

Emergency Connection Boxes Arranged So that Service Can Be Maintained in Case Transformers Feeding Any Section Break Down

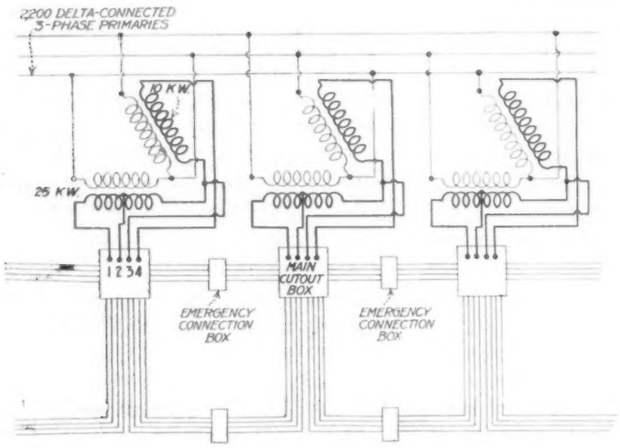
By employing the arrangement represented in the accompanying illustration the Cleveland (Ohio) Electric Illuminating Company prevents the spread of any disturbances and also makes it possible to maintain service in case transformers feeding any section break down. The corresponding terminals of the transformers are connected with different phases so that a practically balanced load is maintained on the three-phase primary circuit.

The secondary system is primarily for 220-110-volt lighting circuits, but three-phase power loads can be carried by the open-delta connection provided. The lighting circuit is connected across terminals 1, 2 and 3, 220 volts existing between the outside wires and 110 volts between the outside conductors and intermediate wire.

The secondary mains are arranged in rectangles, provision being made for connecting adjacent sections through the emergency connection boxes. The circuits at these points are normally left open to prevent the spread of any disturbances which may occur in any section. When the emergency connections are made

they cannot be run straight through, as the phase relations differ in adjacent sections.

If the transformer bank in the middle section, for instance, cannot be used, it is disconnected from its particular section of the secondary system and the corresponding phases are joined in the emergency connec-



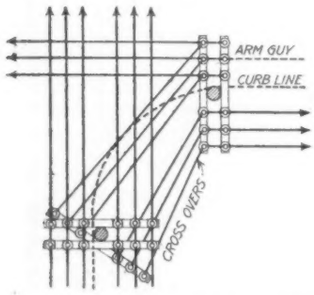
EMERGENCY BOXES SECTIONALIZE SYSTEM BUT PERMIT CONNECTION WHEN NECESSARY

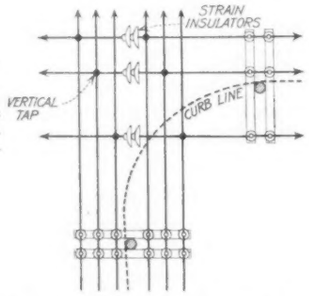
tion boxes between this section and the adjacent ones. With this arrangement the transformers on each side of the section will each be required to carry 50 per cent of the load in the intermediate section.

VERTICAL TAPS SIMPLIFY THE TURNING OF CORNERS

Method of Construction Which May Be Employed at Street Intersections Where There Are Wide Curbs and Rounded Corners

Corner work is often complicated and difficult to install with adequate clearance between wires in cities having wide curbs with rounded corners at street intersections. Single-pole buck-arm corners are generally impracticable even when side or alley arms are used, since the wires are brought too close to buildings thereby. Therefore a double-pole corner must be installed with connecting cross-overs run between poles.





FIGS. 1 AND 2—OLD AND IMPROVED METHODS OF CONNECTING LINES RUNNING AT RIGHT ANGLES

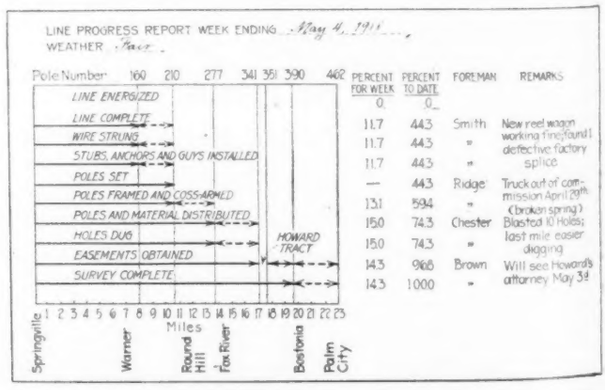
Vertical taps are sometimes employed rather than cross-overs as they give a neater installation. They are, however, more difficult to place, particularly where the poles are so high that the taps cannot be made from tower wagons.

A special installation in which considerable saving in first cost with added safety and simplicity was secured by means of vertical taps and special line insulators is illustrated in the accompanying figures. In this case two independent 11-kv. circuits passed by a street intersection where it was desired to provide a branch from each circuit, one to the right, the other to the left. The usual method of installing cross-overs would have required the construction shown in Fig. 1. Owing to the relatively high voltage of the circuits a 45-deg. buck-arm would have been required on the higher pole in order to secure proper clearances. However, by installing vertical taps and strain insulators as shown in Fig. 2, the construction was greatly simplified, both as to dead-ending and guying. Strain insulators were installed in pairs to secure an added factor of safety, although single units were sufficient for the voltage here employed. The insulators and taps are so placed that under normal operating conditions with both lines energized there is no potential across the insulators. The taps were installed by a lineman working from a temporary steel cable swung across the span.

GRAPHIC METHOD OF MAKING REPORTS OF PROGRESS

Adapted Especially to Transmission and Distribution Construction—Saves Clerical Labor and Still Is Complete

A form of graphic and tabular progress report adapted to transmission or distribution line construction is illustrated herewith. Field construction parties are not ordinarily well fitted for clerical work, and this form of report, which may be blueprinted or mimeographed in advance, will save considerable labor without sacrificing completeness. The lines showing progress for the current week may be dotted, as shown in the diagram, or entered in a different color from the rest of the completed work. If a background of cross-section paper is used with a scale of one hundred spaces to the entire distance, the percentages may be read directly. Vertical lines are drawn and pole num-


LINE PROGRESS REPORT WEEK ENDING May 4, 1918
WEATHER Fair
Pole Number 160 210 277 341 351 390 462
PERCENT FOR WEEK
PERCENT TO DATE
FOREMAN
REMARKS
LINE ENERGIZED 0 0
LINE COMPLETE 11.7 44.3 Smith New reel wagon working fine; found 1 defective factory splice
WIRE STRUNG 11.7 44.3 "
STUBS, ANCHORS AND GUYS INSTALLED 11.7 44.3 "
POLES SET — 44.3 Ridge Truck out of commission April 29th
POLES FRAMED AND CROSS-ARMED 13.1 59.4 " (broken spring)
POLES AND MATERIAL DISTRIBUTED 15.0 74.3 Chester Blasted 10 holes; last mile easier digging
HOLES DUG 15.0 74.3 "
EASEMENTS OBTAINED 14.3 96.8 Brown Will see Howard's attorney May 3d
SURVEY COMPLETE 14.3 100.0 "
HOWARD TRACT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Miles
Springville
Warner
Round Hill
Fox River
Bostonia
Palm City

PROGRESS OF DIFFERENT LINE INSTALLATION OPERATIONS INDICATED BY LENGTH OF LINES

bers entered only at significant points. Obviously every pole cannot be indicated, but indicating the exact pole at which work began or stopped adds definiteness to the report. The proportion of the work done up to date and for the week, the foreman's name and other pertinent information are given at one side of the chart, as shown above.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

ELECTRIC PROCESS IN THE MELTING OF BRASS

H. M. St. John of Commonwealth Edison Company Gives Present Status of Electric Brass Melting and Discusses Central-Station Point of View

Important advances in the art of melting brass by electricity have recently been made, and the present outlook warrants a considerable degree of optimism, says H. M. St. John of the Commonwealth Edison Company, speaking before commercial members of the Ohio Electric Light Association at Cleveland on May 8. "So far as yellow brass is concerned, it cannot be said that an entirely satisfactory furnace has yet been produced," said the speaker, "but the field has been partially covered, and the prospects for future advancement in the art are good. In 1914 it was estimated by H. W. Gillett of the United States Bureau of Mines that there were 3600 plants engaged to some extent in melting brass and bronze. It was further estimated that the value of the metal annually melted by these plants was in the neighborhood of $120,000,000. Of this amount the metal lost beyond recovery during the melting operation was not less than $3,000,000." Mr. St. John continued:

If all the brass and bronze produced in the United States could be melted in electric furnaces, the annual consumption of electric energy for this purpose would be in the neighborhood of 200,000,000 kw.-hr. and the generating capacity required to supply the necessary power would be about 75,000 kw. There is little reason to expect the complete electrification of this industry either now or in the future, but the expansion in this field which may reasonably be expected is sufficiently large to be interesting to the central-station companies.

A central station not only has an object in promoting the satisfactory progress of this development but has at stake interests which can only be protected by a constant oversight of such features of development as directly concern itself. For example, all furnaces are not equally satisfactory from the standpoint of economical power supply, and the power company which expects to furnish power for an electric furnace installation should, for its own sake, be familiar with the electrical and operating characteristics of the furnace.

Not all electric furnaces are good. Good electric furnaces can be misapplied. Such misapplications have been made and are now being made. Good electric furnaces properly applied may result in failure because of faulty operation. This, too, has happened. When such a failure occurs three parties suffer. The user of the furnace has lost some money, but he can go back to his old practice and use a fuel-fired furnace. The seller of the furnace has lost a customer, but he can find another, a few hundred miles away, who has never heard of the failure. The central station has lost an opportunity to extend a profitable phase of its business. Every such failure becomes town talk, in an industrial sense, in the community in which it has occurred, and makes it increasingly difficult to promote the use of electric furnaces in that locality. The business of the central station is generally limited to a relatively small territory, and its loss of possible future profits is correspondingly greater because more concentrated than that of the seller of electric furnaces.

The central-station industry has something to gain by the successful development and use of electric furnaces. It has something to lose by their failure. It is in a position to protect this interest and should do so by informing itself quite fully concerning the possibilities of electric furnace application within its territory.

METHODS OF ASSESSMENT FOR ORNAMENTAL LIGHTING

A Discussion of the Existing Situation in Syracuse, N. Y., Defending the Equal Division Between the City and the Abutters

The question of who shall pay for an ornamental lighting system, and in what amounts and according to what conditions, keeps continually coming to the front. The situation in Syracuse, N. Y., in this connection is discussed by A. R. Acheson, consulting engineer, in the following paragraphs, which were addressed to the Commissioner of Public Safety:

The ornamental lamps were installed and are maintained as an advertising proposition. If this be conceded, then citizens who recognize, with us, that the system is not economical from a lighting standpoint, should ask the question whether the system has been effective as an advertiser of Syracuse and whether such advertising has been of the kind to help Syracuse. In our judgment, the answer must be a decided yes. Consideration of a future system of ornamental lighting should include the advertising feature. Further, if the advertising feature be conceded, then it follows that the cost of maintaining the system should be borne by those benefited by the advertising. The city at large is benefited, but the abutting property owners more especially. If the exact value of the advertising to the abutters and to the city were known, the cost of the ornamental lamps could be equitably assessed. Such advertising value cannot be definitely known, and so an arbitrary division of the cost was established by law, whereby the city at large pays not more than 50 per cent of the cost of the ornamental lighting, the other 50 per cent being assessed on the abutting property owners "in the same manner as are ordinary taxes," *i.e.*, "according to valuation" of the abutting property. As you have shown, the legal authorities now agree that the present law compels assessment "pro rata according to the valuation of abutting property" and does not permit of assessment according to foot frontage or any other method.

When ornamental lamps are installed in any new district of low valuation the burden of the cost of such lighting falls on the high valuation district; hence we have the queer case of the outlying district getting something at the expense of the center district and at the same time getting advertising which attracts trade away from the center district. This is manifestly unfair and has led the city administration to consider having the law changed to permit other methods of assessment. Other methods proposed are these:

1. Assess according to front footage.
2. Assess half of the abutters' cost according to valuation and half according to foot frontage.
3. Assess according to the land valuation only.

Those who advocate retaining some portion of the assessment "according to valuation" do so on the theory that the large department store, for instance, gets more advertising than does the small store with same frontage. This is

debatable. Objectors to foot-frontage assessment say that vacant lots are unduly assessed. It is noticeable, however, that the demand for extension of the system comes from locations where vacant or poorly developed sites predominate. Please note the proof of the advertising feature.

Some contend that the advertising should be paid for as other advertising is—every one pays the same amount for the same quantity of printed matter. Hence ornamental lamp advertising should be according to the foot.

Some say the streets are being used for advertising, and so the cost of such use should be in proportion to the traffic, and hence approximately in proportion to the valuation.

An arbitrary decision must be made. The writer favors assessing 50 per cent on the city at large and the remaining 50 per cent on the abutters according to the front footage, after a deduction has been made for any lighting that is eliminated when such ornamental system is installed.

It may be well to call attention to the fact that if the law is changed and assessments are made according to foot frontage or some similar method, there will be a considerable readjustment of the burden of the cost on abutters. The owners in districts of low valuation will have their assessments increased. This may lead to an agitation for having the city pay the whole cost; in fact, some are raising that issue already. In our judgment, it would be a mistake for the city to assume all the cost of the ornamental system, as that would be discrimination in favor of the center district and would open the way to unwarranted demands upon the city for extensions of the system, the 50 per cent deterrent having been lost.

EXISTING LEGAL STATUS OF CONTRACTS FOR POWER

A Public Utility May Publish Rates for All Classes of Service, but Is Not Permitted to Alter Them by Contract or Otherwise

The often-discussed subject of whether certain deviations from the published schedule of rates invalidate contracts for service was dealt with by Leroy E. Eastman at a recent meeting of the new-business co-operations committee of the Ohio Electric Light Association under the title "The Legal Status of Power Contracts."

He went into the status of a contract which provides that electricity shall be furnished to a certain customer during a term of years at a rate different from the published rate; of a contract which contains a published rate when made and where during the term of the contract the published rate is changed; of a contract whereby the company agrees not to change existing schedules, and of a contract which places a consumer in a class other than that in which his actual physical condition would naturally place him.

The author pointed out that the courts of every state have consistently condemned every special contract or private arrangement which differed from the regular published schedules and which in effect created a preference, or which tended to discriminate in favor of an individual consumer. The intention of the parties, he stated, is of no consequence, and the only consideration is the question whether or not the situation in which the court finds the parties is one which will lead to an evasion of the statute and will open the door to unequal rates.

This is upon the general principle that ignorance of the law is no excuse, and if the direct object of the parties is to do an illegal act, the agreement is void, and it is immaterial that either or both did not know that the object was illegal, and also upon what is perhaps the more sound view that the published schedules are open for public inspection at all times and the consumer is charged with knowledge of their contents.

Thus, it was stated, a contract specifying rates less than those named in the schedule is wholly illegal and will not be enforced though there was no intention to violate the act. Furthermore, contracts fixing rates for a series of years are of no force, it was shown, against subsequent lawful change in rate within the period covered by the contract. Such contracts have been condemned in many cases. The courts adopt the view that the law is a part of every contract, and the parties to such a contract take it subject to any change which may thereafter be made in the rate.

It was also stated that contracts which attempt to place a customer in a certain class are held to be invalid.

In considering each of these situations actual cases were cited, and in every one the only point in which the courts seem to be interested, according to the author, is whether or not the contract or arrangement amounts to discrimination or produces any of the results forbidden by the statute.

No distinction, it is stated, has been made between contracts made before and those made subsequent to the passage of the public utility acts. It would seem that the various state statutes would not have the effect of abrogating pre-existing contracts because of the provision of the federal constitution that the state shall not pass laws impairing the obligation of contracts; but the courts hold that such acts are properly within the police power of the state and may be enforced even against pre-existing contracts.

"It seems clear," the author said in conclusion, "that the duty of the utility is to publish a tariff for every class of service which it has to sell, and that it has no power to alter or vary the rates fixed by those schedules by any contract, arrangement or device whatsoever. A complete remedy is afforded by the statute to both the utility and the consumer by complaint filed with the commission for relief both against insufficient and against unreasonable rates."

METER ACCURACY OF ONE COMPANY AFFECTS OTHERS

Good Practice for Large Companies to Check Standard Meters of Smaller Neighboring Utilities if Requested to Do So

It is the policy of the Minneapolis General Electric Company to calibrate the rotating standards of the smaller neighboring utilities at cost. This plan is adhered to regardless of any amicable relations that may have been established between the larger company and its smaller neighbors by underlying financial relations or by cordial relations among the personnel of the organizations. It is thought to be good policy purely in the interest of keeping all nearby standard instruments in accurate running condition. This accuracy in turn is reflected in the meters of individual customers. Hence, when the Minneapolis company gets a new customer who has been living in one of the surrounding towns it does not get from him a complaint arising from the fact that his meter at his old home was slow while the meter in his Minneapolis home registers correctly. Such a condition was entirely likely under the older methods of handling meters.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Relative Advantages of Three-Phase-Monophase Current Converters.—CESARE DELLA SALDA.—The synchronous type of converter, besides being able to function simultaneously as a synchronous condenser, has the possibility of being used with more than three phases. The series type, in its varied forms, is simpler, does not require automatic apparatus and is more economical. This type is advantageous if it is desired to derive current from a single phase of a three-phase network. It does not, however, permit correction of power factor. The different types of asynchronous converters have the advantage of improving the power factor.—*L'Ettrotecnica*, March 25, 1918.

Generation, Transmission and Distribution

Fuels and Their Efficiency for Central Stations.—NEWTON HARRISON.—Good and bad fuels, heat value and composition of fuels, free-burning fuels, caking, coking, difference between anthracite and bituminous coal, the amount of air required, low-grade fuels and the amount of heat required to evaporate water are subjects discussed in this article.—*The Central Station*, April, 1918.

Improvements in Waterwheel Efficiency.—E. C. HUTCHINSON.—The subject is divided into three parts: (1) Improvement in power output by the installation of modern waterwheel runners, the rest of the equipment remaining the same; (2) improvement of power output through decreasing the size of the water-economizing nozzle; (3) general improvement of the entire unit by installing both modern waterwheel runners and water-economizing nozzles.—*Journal of Electricity*, April 15, 1918.

Electric-Power Supply at Buenos Aires.—This article deals with the equipment and various classes of apparatus used in the installation and is copiously illustrated with instructive diagrams.—London *Engineering*, March 1, 1918.

Joint Operation of Power Companies.—J. P. JOLLYMAN.—The results of operating power companies jointly, made possible by the interconnection of their power lines, are embodied in an appendix to the article.—*Journal of Electricity*, April 15, 1918.

Linking Up Rural Communities in Iowa.—How the inefficiency attending the independent operation of comparatively small electric light properties in Ohio has been avoided by interconnecting their systems is discussed in this article.—Chicago *Electrical Review*, April 6, 1918.

Use of Pulverized Fuel and Its Possibilities in the War.—F. P. COFFIN.—The first section briefly summarizes the advantages of pulverized coal, treats of the suitability of its use as fuel for stationary boilers, locomotives, steamships and metallurgical furnaces, and recommends its adoption to conserve our coal resources and to release for military use the fuel oil now burned for industrial purposes. Following a description of the indispensable part that electric power plays in the preparation, handling and burning of pulverized fuel, the second section of the article presents an impressive list of the American users of pulverized fuel.—*General Electric Review*, May, 1918.

Interconnected Power Systems of the South.—This article deals with the hydroelectric systems of independent companies operating in five Southern states which are interconnected into one vast transmission system, permitting considerable economies in operation. The layout of the different plants and statistical data regarding their ratings, loads, power factors and yearly output are given in the article, which is illustrated by a map showing the high-tension network considered.—*Metallurgical and Chemical Engineering*, May 1, 1918.

Secretary Lane Urges Water-Power Development.—An interview with Secretary of the Interior Lane, who is quoted as saying: "The electrochemical industries of the United States have been found particularly essential to the conduct of the war, and yet they have not had adequate power. If these industries are to be fostered in this country and their extension made possible, it will be necessary to provide more power; otherwise we are confronted with the expatriation to more favorable localities of those industries which should be established here. More power should be developed at Niagara, and I believe that the United States and Canada should enter into an agreement for a large international development there that will make 1,000,000 hp. available to both countries. It is not at Niagara alone, however, that we need to develop water power. Our program should encourage development throughout the country wherever there seems to be a necessity for it and wherever we have mineral resources contributory to electrometallurgical industries."—*Metallurgical and Chemical Engineering*, May 1, 1918.

Hydroelectric Economies.—J. P. JOLLYMAN.—As much as 77 per cent in over-all efficiency has been obtained in the hydroelectric plants of one Pacific Coast company by replacement of obsolete equipment and other improvements in combination with an effective system of testing and checking performance. The best efficiency obtained with impulse wheels was about 82 per cent and with Francis turbines from 85 to 87 per cent. The value of accurate continuous records of the amount of water supplied to the hydroelectric plants has justified the installation of Venturi meters in the pipe lines of their most recent plants. Automatic nozzle control is not used on any of the impulse units. All of the high-head Francis turbine units are equipped with relief valves adjusted to close automatically when desired. "Improvements in efficiency may be expected," says Mr. Jollyman, "from a change in buckets, (a) if the form of the original buckets does not approximate closely to the best modern types, (b) if the buckets have become pitted or waved, (c) if the buckets have

so worn at the entrance as to permit the spilling of live water, or (d) if the buckets have holes worn through them to a material extent." Data showing the pipe-line, waterwheel, generator and transformer efficiencies of three hydroelectric plants are given.—*Journal of Electricity*, April 15, 1918.

Traction

Railway Substation for Paris Railway.—LUCIEN PAHIN.—Description of the substation erected in 1914 at Bagneux on the electrified railway line extending from Paris to Anthony, a distance of 8.3 km. (5.18 miles). This substation is rated at 1300 kw., two six-phase commutators of 425 kw. each having been installed, with provision for a third. Three-phase current at 50 cycles and 15,000 volts is furnished by the central station at Issy-les-Moulineaux and stepped down to 450 volts.—*L'Industrie Electrique*, March 25, 1918.

Installations, Systems and Appliances

The Radioscope in the Treatment of Wounded Men.—A new radioscopic method of discovering projectiles in the bodies of the wounded. The apparatus requires only a disk and two wires, and it necessitates no calculation, no tracing on the screen and no removal of the patient. The location of the foreign body is shown by a simple reading.—*Revue Générale de l'Electricité*, March 30, 1918.

Steel Plant Applications.—F. B. CROSBY.—The article is devoted to a description of the process of manufacture of steel wire at the plant of the Keystone Steel & Wire Company, starting from the raw materials with which the open-hearth furnaces are charged and ending with the finished product. Interspersed between the sections describing the process are descriptions of the electric equipment which vitally contributes to the successful operation of the plant. The layout of the plant is illustrated by diagrams, and curves are presented showing the speed-horsepower and speed-torque for reversing blooming mill drive.—*General Electric Review*, May, 1918.

Electric Furnaces for Melting Brass (Editorial Comment).—The main reasons underlying the economic change, now taking place, from fuel-fired to electric brass furnaces are to be found in the conservation of time, metal and fuel, improvement in the sanitary conditions of the foundry, and the higher strength and uniformity produced. The metallic loss, especially of zinc, is said to be reduced to at least one-half. With thermal efficiency averaging perhaps seven times that of a fuel-fired furnace, the electric furnace affords a great saving even when using energy from a steam-electric plant. With hydroelectric current the saving is considerably increased. The saving of time and labor per unit of production is of special importance, especially under present industrial conditions. There are on the market to-day over a dozen different electric furnaces for non-ferrous metallurgy, representing five different types, namely, induction, radiating-arc, direct-arc, resistance and high-frequency. These are used for the production of a variety of metallic alloys which may be classified substantially as follows: (a) yellow brass with less than 3 per cent lead; (b) red brass and bearing-metal irrespective of the lead content; (c) red brass with low lead content, and (d) the aluminum mixtures. The induction furnace is the type hitherto found most suitable for melting yellow brass with a spelter loss of 1 per cent or less. This is due to that characteristic of the induction furnace which permits accurate heat control, with consequent uniform temperature throughout the bath of metal. The advantage is obvious if it is desired to keep the volatilization of zinc at a minimum.—*Metallurgical and Chemical Engineering*, May 1, 1918.

Miscellaneous

Eliminating Corrosion Caused by the Carbonic Acid Contained in Steam.—CH. CHOROWER.—In an article previously published (*Revue Générale de l'Electricité*, Nov. 17, 1917) the author attributed the corrosion of boilers and steam-driven machinery to the action of the carbonic acid contained in steam and advocated ridding the feed water of this gas. In the present article he gives the result of seven years' work along this line and claims to have demonstrated scientifically, as the outcome of experiments in the central station of Lisbon, Portugal, that by preliminary chemical treatment of the water and subsequent watchfulness corrosion can be eliminated.—*Revue Générale de l'Electricité*, April 6, 1918.

The Rivetless Ship a Possibility.—Electric welding as a substitute for riveting is being tested by the government at four shipbuilding yards, and so far the work is proving highly satisfactory. According to recent data, the process will increase the strength of the joint at least 25 per cent and decrease the time to get out a hull nearly 50 per cent. Eminent marine engineers claim that there will be a saving in labor of 60 to 70 per cent. The machine employed is the Wilson welder. At present the plates are being lap-welded, the plates being overlapped at least 2 in. (5.1 cm.), sometimes more, and each edge welded down. In the future it is the intention to butt-weld the plates, in which case they will be beveled so that when placed edge to edge V-shaped grooves will be formed, into which the welding metal will flow, leaving a welt over the top of the V. The reverse side, the one exposed to the sea, will be left perfectly smooth. By this method considerable steel will be saved which otherwise is wasted by overlapping, and at the same time the weight of the ship will be reduced. Plates 3½ in. (8.9 cm.) in thickness have been welded, this being the maximum thickness used on the particular jobs where observations are being made. The advisability of casting entire steel sections and then welding them together is also under consideration. While electric welding will eliminate the use of rivets to a large extent, there is at present a certain amount of riveting to be done in attaching the plates to the frames. Repair work can be done without removing the broken parts from a ship. When a vessel comes into port with a broken cylinder the repair can be made on board. No preheating or annealing is necessary. A novice can be developed into a satisfactory electric welding operator in thirty days, and from available data it is estimated that thirty welders can do the work of 125 riveters. The Wilson welding outfit operates on what is known as the arc principle and consists of a motor-generator set, the generator of which is wound for 35 volts. The welding metal serves as one electrode, while the ship plates constitute the other electrode.—*Marine Review*, May, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Apparatus Available*

LAMPS, ACCURATE LIFE TEST.

Booster transformers are used in the individual lines to life-test racks for incandescent lamps, in order to maintain the exact voltages required, irrespective of the load. There are forty voltage steps, covering a total range of less than two volts.—*Clayton H. Sharp, Electrical Testing Laboratories, New York City.*

Suggestions for Research*

ARC RECTIFICATION.

A systematic study of very short arcs or sparks displaying themselves between two electrodes of different material is urged as a means of developing rectification methods. Water-cooled copper as the anode and carbon as the cathode seem to be quite suitable for this work. The arc gap ought to have large cooling flanges which tend to enhance the de-ionization and to reduce the temperature of the path of the arc at the time when the arc is supposed to be extinguished. A careful study of a quenched spark gap would be a good introduction to any one who should care to attack this rectifier problem.—*August Hund, Berkeley, Cal.*

CABLES, TEMPERATURE RISE IN.

The temperature that ducts and conductors will attain when laid in duct systems in different kinds of earth would be interesting; also the relation of surface temperatures and of the ambient earth temperature to those in the ducts. Research along this line should comprise tests on duct systems having different numbers of ducts well filled with cables which are operating under light, normal and heavy loads. The radiating power of duct structures, surrounded by different kinds of earth or sand, should also be studied at different times of the year. Careful consideration should also be given to the rate at which the temperature drops from the duct structure outward and what effect the street covering has on this gradient. Recently one company lost several cables because the streets were covered with asphalt pavement. On taking up the pavement it was found that the soil around the duct structure was absolutely dry from excessive heat, the asphalt paving having prevented the water from entering the soil around the ducts.—*H. W. Fisher, Standard Underground Cable Company, Perth Amboy, N. J.*

CONDUCTORS, MECHANICAL STRENGTH.

A method of determining the mechanical characteristics of composite strands of cables made up of steel and copper wires of various percentages of the two metals would be valuable. Perhaps the greatest experimental difficulty in testing the samples of cable to be examined would be in providing terminal attachments. They must be such as to avoid having one or more loose wires in a strand when the load is first applied. This would naturally be more difficult the shorter the sample.—*H. H. Cochrane, Montana Power Company, Butte, Mont.*

CONDUCTORS, SKIN EFFECT.

It would be of interest to know the skin effect in a composite strand about 0.4 in. (1 cm.) in diameter, made up of a central steel wire surrounded by three steel wires and three copper wires arranged alternately around the center. This conductor would be used for high-voltage lines of small or medium power capacity, in which the size indicated would be required to avoid corona, but only the copper indicated would be required for conductivity.—*H. H. Cochrane, Montana Power Company, Butte, Mont.*

CONDUITS, HEAT TRANSMISSION.

The thermal resistance of duct lines to dissipation of heat is of considerable importance in determining the temperature rise of cables. Since a study of actual conduits is rather difficult because of the many variables involved, the following method is suggested: Make up from sheet metal small unit-length models of a conduit line and place in a glass vessel filled with an electrolyte to represent the soil around the ducts. Measure the resistance between the duct and surface of the electrolyte which corresponds to the earth's surface. In this way the effect of duct arrangements and conduit depths can be studied and certain constants obtained which would be applicable to actual conduit lines.—*Richard C. Powell, San Francisco, Cal.*

CONSTANTAN.

Relation between the composition of constantan and the stability of its thermal emf. with use under various conditions of oxidizing and reducing gases.—*M. E. Leeds, Philadelphia, Pa.*

CORONA.

The influence of temperature and air pressure on the electric breakdown of air should be known in connection with the use of the corona voltmeter.—*J. B. Whitehead, Johns Hopkins University, Baltimore, Md.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

GENERATORS, DIRECT-CURRENT.

It would be very desirable if direct-current generators up to 500 kw. or thereabout could be successfully built to operate at 3600 r.p.m. in order to allow direct connection to a steam turbine.—*M. D. Church, Terry Steam Turbine Company, Hartford, Conn.*

INDUCTION GENERATOR, HIGH-FREQUENCY.

A high-frequency generator could probably be built by using an asynchronous machine with a set of condensers. The nature of this device is entirely different from that of the Goldschmidt alternator, since the latter builds upon the reflection principle while in the induction generator an oscillating mutual induction is probably utilized.—*August Hund, Berkeley, Cal.*

LIGHTNING PROTECTION WITH BARBED WIRE.

In place of the ordinary grounding arrangement consisting of heavy copper or iron plates embedded in carbon in damp soil, the author recommends using about 10 m. of ordinary galvanized barbed wire wrapped into a coil about 1.5 m. in circumference. The turns must be placed close to each other so that an electrical discharge could readily jump across. The wire should be placed in vegetable earth, or where some vegetation is planted on top, so that moisture will be assured. The advantages of such an arrangement are large surface, favorable discharge characteristics due to the points, and the absence of a soldered joint. Limited experience seems to indicate that such protection is quite satisfactory, but further and more elaborate tests are recommended.—*H. M. Levylier, Escuela Industrial de la Nación, Buenos Aires, Argentina.*

MAGNETS, PERMANENT.

The influence of heat treatment and of chemical composition of steel upon the characteristics of permanent magnets offers a field for investigation.—*M. E. Leeds, Philadelphia, Pa.*

MALLEABLE IRON, MAGNETIC PROPERTIES OF.

Malleable iron has been used by the writer in the construction of small generators and motors, and, while the permeability is much lower than that of cast steel, being apparently about one-half, yet nearly the same flux density can be used. The material is much cheaper and lends itself much better to machine-shop operations. Malleable iron has been substituted for cast steel in the field frame of a number of starting motors for starting automobile engines without any apparent difference in the characteristics. The writer has never been able to find any considerable amount of data bearing upon this material, and yet the subject seems to be of great commercial importance.—*Benjamin F. Bailey, University of Michigan, Ann Arbor.*

PROTECTIVE DEVICES.

The form of electrostatic field which would break down in the shortest time and over the greatest area would be interesting in connection with the design of protective apparatus. The greater protective value of a sphere gap against over-voltages as compared to a needle gap is due to the fact that the sphere gap has a smaller time lag. An umbrella gap probably has a still smaller time lag because the electrostatic field is more uniform. —*Editorial Suggestion.*

SURGES IN CABLES AND OVERHEAD LINES.

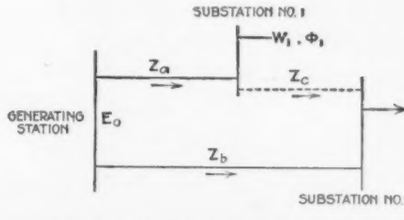
The following experimental arrangement affords a simple means for laboratory investigation of traveling surges with a steep wave front. Take a single-phase cable or overhead line, a few hundred feet long, and connect one end of it to a source of moderately high direct voltage. Connect to the cable the measuring devices and apparatus upon which it is desired to investigate the action of a surge. Keep the other end of the line open and then suddenly short-circuit it. This will produce a steep wave surge, from the generator out, with all its characteristic phenomena. For example, a wave will jump a spark-gap in series with the conductor rather than go through a low resistance loop shunted across the spark-gap.—*Editorial Suggestion.*

TELEPHONE, LOUD-SPEAKING.

There is still a wide field for further improvement of loud-speaking telephones and for a scientific study of the best conditions. The hot-cathode amplifier might easily prove to be a useful adjunct in such devices. (The development of corrective devices for the deaf is of particularly practical and humanitarian importance now that many soldiers will soon be returning from the war with their hearing rendered defective on account of the hardships encountered at the front.—*Editorial Suggestion.*

TIE-LINE PROBLEM.

The following problem is of interest to operating companies, and it is desired to obtain a solution, analytical, graphical or combined, in such a form that even one not well versed in the intricacies of alternating-current vectors or complex quantities could apply it to his own case. Referring to the accompanying diagram, two substations are fed each with polyphase power



from a station bus through one or more lines in parallel. The combined impedance of the feeders to substation No. 1 is Za, of those to No. 2 is Zb. The loads W_1 and W_2 as well as the phase angles ϕ_1 and ϕ_2 at both substations are given. The feeders to substation No. 2 are overloaded, and it is desired to add a tie-line marked Zc. The problem is to find the new electrical conditions when the tie-line Zc is of a given size in operation, or to find the size that would bring about the desired relief. Of particular interest are the currents in Zb and Zc. Readers are invited to contribute solutions to this problem.—*Editorial Suggestion.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

CHARLES A. COFFIN HONORED BY FRANCE

Chairman of Board of Directors of General Electric Company Given High Rank of Officer of the Legion of Honor

The French government has conferred on Charles A. Coffin, chairman of the board of directors of the General Electric Company, the rank of Officer of the Legion of Honor. This was done through Justin Godart, formerly Assistant Secretary of War of France, who is in this country on a special mission.

The honor given to Mr. Coffin is in recognition of his services as a member of the executive committee of the War Relief Clearing House for France and as a member of a committee of prominent Americans promoting the establishment of scholarships in French universities for American students after the war.

Mr. Coffin is the only Officer of the Legion of Honor in America.

As is generally known in the electrical industry, Mr. Coffin has given devoted service to the great work of war relief.

ANNUAL MEETING OF SOCIETY FOR ELECTRICAL DEVELOPMENT

Work of the Society to Be Continued for Another Year on Present Basis—"Convenience Outlet" Campaign Planned

The annual meeting of the Society for Electrical Development, Inc., was held on May 14 at the offices in New York. James R. Strong presided.

James M. Wakeman, general manager, read his annual report, reviewing the work during the year and suggesting activities for the coming year. The report of the treasurer, James Smieton, Jr., was read and accepted, together with the auditor's report.

The election of directors resulted:

Representing central stations—J. E. Montague, four years; W. W. Freeman, two years; E. N. Sanderson, one year.

Representing manufacturers—L. P. Sawyer, four years; W. D. Steele, one year.

Representing jobbers—Fred Bissell, four years.

Representing contractors—G. M. Sanborn, four years.

At the directors' meeting which followed, with J. E. Montague presiding, it was decided to continue the work of the society for another year upon the present basis and to conduct a "convenience outlet" campaign as suggested by the general manager. An appropriation was made to carry on the campaign along national lines, similar to the "Wire Your Home" and "America's Electrical Christmas" campaigns.

The society will issue broadsides, booklets, folders, lithographed posters, etc., and will ask local committees to procure the co-operation of the entire electrical industry in educating the public to an appreciation of "convenience outlets" of all kinds, such outlets to be preferably on a separate circuit from the lighting. It is felt that the time is opportune for such a campaign inasmuch as domestic servants are scarce and people have money to spend upon appliances, the proper use of which plays an important part in fuel conservation.

Henry L. Doherty was again elected president. Joseph E. Montague was elected to succeed W. H. Johnson as vice-president and as a member of the executive committee. Gerard Swope was elected chairman of the executive committee. James M. Wakeman was reappointed general manager and James Smieton, Jr., secretary-treasurer for the ensuing year.

I. E. S. DISCUSSES VALUE OF PROTECTIVE LIGHTING

Chief of Federal Plant Protection Bureau Outlines Its Work and Shows Relation of Illumination to Watch System Used

Some very practical hints regarding the best methods of utilizing artificial illumination to help in the protection of industrial plants against marauders were outlined by Edmund Leigh, chief of plant protection, Military Intelligence Bureau, at the May 9 meeting of the Illuminating Engineering Society held in New York. In discussing the subject of protective lighting he pointed out that very few industrial plant managers know the value of illumination in preventing crime and that they have to be educated as to its proper use. This the plant protection bureau is doing, but illuminating engineers and engineers connected with electric service companies and manufacturers of lighting equipment can help considerably.

Floodlighting produces beneficial results in many cases, but if not properly used it will blind the watchman and defeat its purpose. In many cases considerably better results can be obtained with localized lighting, using deep-bowl reflectors. The best results can be obtained by studying the watch system employed and adapting the lighting system to it rather than vice versa as it is usually done. Silhouette lighting is also very effective, the speaker declared, since long tracts can be guarded in this way without disclosing the position of the watchman. To give an example of how this form of lighting can be used, he referred to experience he had many years ago in guarding the Bowery in lower New York. By standing where he could see a light at the far end of the tract which he had to watch he could see marauders if they stepped between him and the light.

At the McCook aviation test ground very effective protective illumination in the form of searchlamps mounted on sentry towers is employed. Several of these towers are used, the lamps being arranged so they can be easily directed by sentries in the towers.

Mr. Leigh said that whenever the plant protection

branch of the Military Intelligence Bureau cannot cope with a protective lighting problem he calls in illuminating experts.

In the discussion which followed Mr. Leigh's talk the following men took part: George H. Stickney, Mr. Porter, Preston S. Millar and Mr. McGuire.

Mr. Stickney emphasized the need of designing protective lighting systems to fit the method of watch service employed. He also pointed out that lighting mains are often too accessible to persons who might tamper with them.

Mr. Porter had pictures cast on a screen showing different methods of protective lighting. He said that most of these are shown in the booklet which the Illuminating Engineering Society has prepared for the government. One of the principal methods of lighting shown was by means of floodlamps giving a relatively narrow dispersion of rays placed so that the light illuminated a tract parallel to the place that had to be protected. The speaker pointed out that if the dispersion is too narrow a marauder can cross the illuminated space easily and escape in the darkness.

Mr. Millar also referred to the booklet on protective lighting which the Illuminating Engineering Society has prepared for the government.

Mr. McGuire described a protective scheme which he had found very effective. An unclimbable fence was stretched around the building to be protected and the most vicious dogs that could be obtained were turned loose in the space between the fence and the building. Watchmen are stationed at the four corners of the building, and time clocks must be rung one-half minute apart. Thus no watchman can ring for another.

Another speaker called attention to the undesirable use of high-intensity small-spread lamps too close to the ground, saying that lamps of smaller intensity equipped with stippled glass screens to reduce the intrinsic brilliancy of the source are much better. He expressed the belief that the best lighting for railroad yards can be obtained by using deep-bowl reflectors. Flame-arc or incandescent lamps are suitable under such conditions.

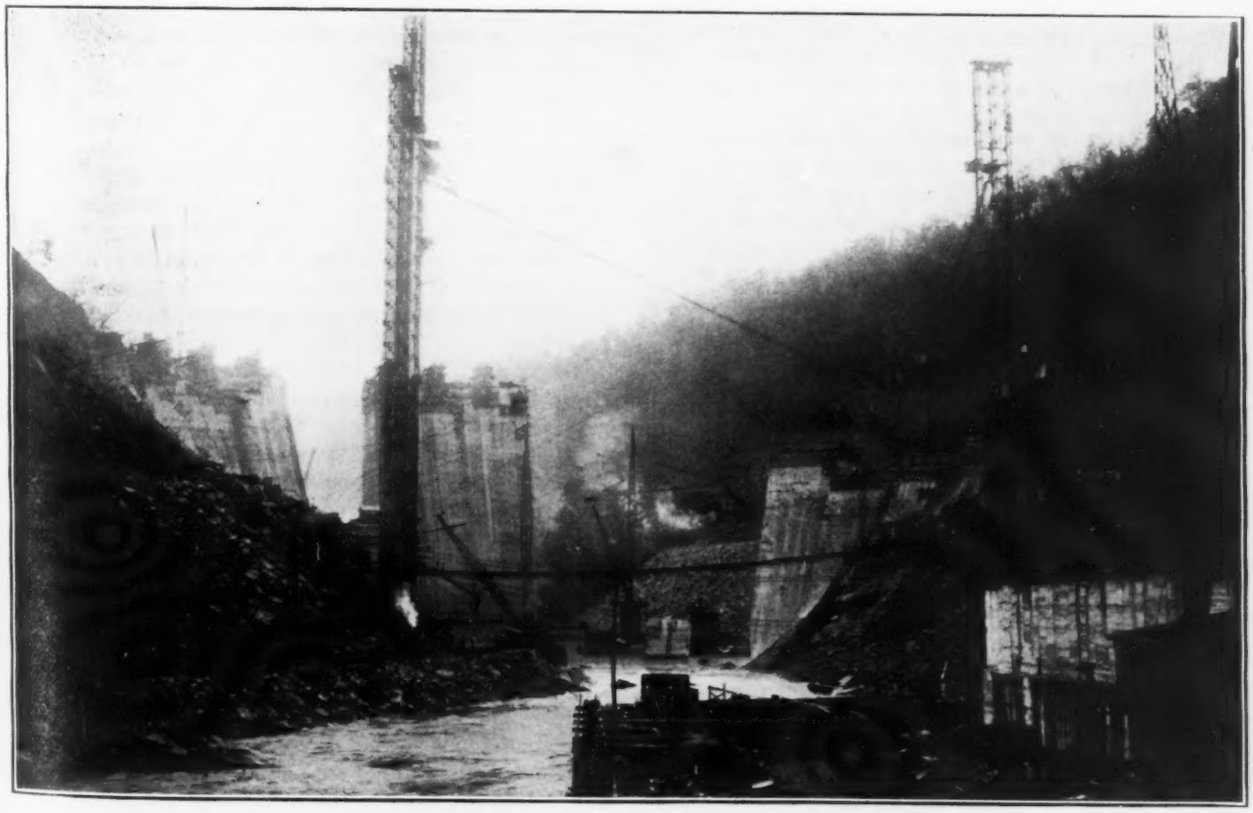
Bassett Jones, Jr., also presented a paper entitled "An Instance of Industrial Lighting," in which he explained how to lay out a flexible distribution system for interior lighting.

SECTION FOR HEATING AND CURRENT-CONSUMING DEVICES

Meeting to Be Held on May 28 to Form New Section of the Associated Manufacturers of Electrical Supplies

By request of many of the leading manufacturers, a meeting has been called for Tuesday, May 28, at 2 p. m., at the offices of the Associated Manufacturers of Electrical Supplies, New York, to consider the advisability of forming a section in the association to include manufacturers of the various forms of heating and current-consuming appliances for household and industrial purposes.

Such a section has been under contemplation for some time, says Charles E. Dustin, general secretary of the association, and the conditions now seem opportune for accomplishing what it is conceded must be of lasting value to the industry.



HARNESSING THE SOUTHERN RIVERS FOR INDUSTRIAL PURPOSES

The 80,000-hp. development of the Aluminum Company of America at Cheoah, on the Little Tennessee River. The first of a number of hydroelectric stations to be built along that river.

Water-Power Hearings at Washington Concluded

It Is the Expectation that the Special Committee of the House of Representatives Will Report a Satisfactory Water-Power Bill to the Present Session of Congress

HAVING heard the various Cabinet members who will constitute the commission on water power proposed in the "administration" bill, and also engineers, financiers and others interested in water-power legislation, the special committee of the House of Representatives will conclude the hearing this week and discuss the matter further in executive session with a view to reporting a workable bill at the present session of Congress.

The Secretaries of War and of Agriculture appeared before the committee on Wednesday and elucidated that portion of the bill dealing with recapture and particularly the part defining net investment. Otherwise they added nothing of importance to the measure, which already embodies their ideas as well as those of the Secretary of the Interior. Senator Thomas J. Walsh of Montana also appeared before the committee on Wednesday to offer two minor amendments, and Representative at Large Frank W. Mondell of Wyoming discussed the various provisions of the bill on Monday. Mrs. H. W. R. Strong of Los Angeles, Cal., asked the committee on Tuesday to exclude from present development the Colorado River in the Grand Canyon of Arizona, preferring that that be made a government reservation until such time as the government itself may choose to dam the canyon and use the electricity for irrigation and other purposes.

STATEMENT OF SECRETARY OF WAR BAKER

Secretary Baker commented on the bill as originally submitted by the three secretaries and also on the effect of the proposed amendments subsequently offered. The latter he said were introduced for the purpose of clarity. His own view is that the terms of the franchises provided for in the "administration" water-power bill shall be definitely limited to fifty years. On this point his testimony was as follows:

"As the bill was originally introduced it was drawn by Secretary Lane, Secretary Houston and myself and represented the consensus of opinion as to what would be desirable in a bill that would meet the views of the legislators who had been considering the subject up to that time. The substitution of the phrase 'net investment,' with a concise and inclusive definition of that phrase, was for the purpose of enabling the committe to consider a bill which had a repetition of that phrase throughout, carrying with it always the identical definition and not requiring the extraction from the body of the bill, in various places, of limitations to be used in determining the recapture price. I thought when I went over it that the phrase 'net investment' as defined here was a clearer definition of exactly the same intention as had been expressed in the original phrases. I do not feel, however, that the adoption of that phrase or that method is at all essential to our concurrence in the bill as originally drafted.

"We have to decide at the outset whether a fixed term is to be used, at the end of which there is an end of the rights of the licensee, or whether we are going to spread the investment of any licensee over an indefinitely prolonged period under proper safeguards. If it be determined that a single term of fifty years is to be the principle of the bill, then any investor must, whether you provide it in the bill or not, amortize the investment in fifty years. That means that the consumers during the fifty years will have to pay by that much a higher rate than they would have to pay if they covered in their rates merely obsolescence and replacements and did not sink the entire original cost during the period of the grant. If the primary object is to secure a minimum rate to the consumer, the course of having consecutive terms would be the proper course.

"The purpose of this bill was to have a fifty-year term, and at the end of the fifty-year term the government was to have the three options of either taking over the property, granting it to a new licensee or regranting it to the original licensee or his successors in interest. The intention of the bill was to make those three options identical, so far as the financial obligation was concerned. If the government took it over, it would pay X dollars; if it granted it to a new licensee, the new licensee would pay X dollars; if it regranted it to the original licensee, it would ascertain and fix, as a new starting point for his net investment, X dollars, the same number of dollars in each instance. The purpose of the bill, as originally drawn, I think—and certainly as clearly shown by the amendment—was not to sink and amortize the original cost during the first term, but to carry that investment—depreciate it so that at any particular period of renewal it represented the actual value—to carry that forward as a continuing asset in the licensee, either to be repaid to him by any other licensee or by the government or to be regarded as his investment at the beginning of the new license period.

"Now, my own judgment, my very strong preference, is for the first of those courses, to fix an absolute term and to allow the government not to have a system of equities built up against it at the end of that term. If that were done, it would cost more to the consumer clearly, but if it is intended to do that, it ought to be so clearly done that when the first term or first license does expire, there will not be any doubt that the government has a right to expect the licensee to have protected himself by amortization during the period.

GOVERNMENT CONTROL OF INTRASTATE RATES

"Now, there is one other point that has been raised here upon which I want to say a word, and that is the question as to whether or not it would be possible to put in this bill the control of rates by the federal government on *intrastate* business of such a character as to assure the building up of an amortization fund. I am not prepared to express an opinion on that subject

as a lawyer, but I remember a somewhat similar case to which I would call attention.

"In the State of Ohio a telephone company made a contract with the city of Toledo whereby the company got a franchise to operate telephones in that city and agreed to charge a stipulated rate for domestic and business telephones. After it had constructed its plant it started to charge a much higher rate for both business and domestic telephones. A suit was brought, I think, in quo warranto, for abuse of franchise, and it was decided in the Circuit Court in Ohio that the power of the city of Toledo in the matter of the granting of a telephone franchise was not to make a contract with regard to rates but merely to determine whether in the public interest the public highways might properly be used for the erection of telephone poles and wires, and that therefore the subject of rates was outside of the purview of the contracting power of the city and the telephone company; that it must be assumed that the subordinate governmental agency had correctly decided the convenience of the government in allowing the erection of these facilities, and that its attempt to inject into that decision a contractual relation with regard to a subject matter where it was not authorized to contract was ultra vires and entirely nugatory, and that the company could continue to enjoy the grant of the right to occupy the streets without being bound by the obligation as to rates. That is the case of McMahon against the Home Telephone Company, and it is the Circuit Court's decision, but it was afterward affirmed by the Supreme Court.

"Now, if the federal government dealing with public lands and the public forests has a different kind of right from that which it has in dealing with navigable rivers, and its contract with a licensee proceeds in the one case from a proprietary interest which might be made the basis of a contract, where in the other case it is exercising a governmental power of regulation, it might well be that a provision in this act authorizing the fixing of rates in intrastate business would be upheld with regard to the public lands and the public forests, where it rested upon a proprietary interest in the government as a contracting party, and not upheld with regard to navigable streams, where the basis of the power is the regulation of the streams in the interest of navigation. I simply cite that as being a difference which may arise. In my own judgment, if the term is fixed definitely at fifty years and there be either an explicit statement or so plain an inference in the bill that the rights of the licensee then terminate, you will force both upon the licensee and upon any local regulating body the obligation of including in the rate a sum which will provide for amortization. In other words, I think the courts would enjoin, as confiscatory, any rate which was sought to be imposed upon a public utility living under the definite and fixed term 'grant,' with no equities of renewal, a rate which did not authorize it to collect enough to pay its running expenses and amortize the investment during the period of the grant."

WHAT CONSTITUTES FAIR VALUE

Secretary of Agriculture Houston, in discussing net investment as defined in the amended measure, said that the original draft of the bill provided for recapture of the water-power development at fair value. In suggesting the term "net investment" as the basis for payment it was thought it would not be susceptible to any misunderstanding or misinterpretation inasmuch as the term was specifically defined. However, it is inconceivable that there should be any unappropriated surplus to deduct from the original cost as required in the measure (see ELECTRICAL WORLD, March 16, page 581), and for that reason he suggested the following amendment to the clause on "net investment" as defined in the amended measure or to "fair value" as understood in the original draft:

"That out of surplus earnings, if any, accumulated in excess of a specified rate of return upon the net investment of the licensee in any project or projects under license the licensee shall establish and maintain amortization reserves, which reserves shall, in the discretion of the commission, be held until the termination of the license or be applied from time to time in reduction of the net investment. Such specified rate of return and the proportion of such surplus earnings to be paid into and held in such reserves shall be set forth in the license."

Should the government at the end of the fifty-year period take over the project that sum would be deducted from the original cost. Whether or not to make amortization within the fifty-year period compulsory was a question of policy for the committee to decide. To do so would mean higher rates for the electric service during the life of the franchise, which the utility has a perfect right to exact.

OPINIONS OF CONGRESSMEN

Representative Ferris gave as his opinion that the term of the lease should be definitely fixed at fifty years and that the government should not be required to pay back every cent put into a project. Secretary Houston was, however, in favor of succeeding terms under proper regulations and safeguards and on terms which would be reasonable under the conditions then existing. He also was of the opinion that one body should treat all water-power matters including boundary waters covered by treaty.

It was the opinion of Representative Mondell of Wyoming that a good right-of-way measure would be preferable to the present water-power bills since most of the water powers are on non-navigable streams. He was not in favor of a recapture by the government because it fixed a time at which investment values would be disturbed, and this had to be taken into consideration in fixing a rate. What is needed, he said, is the largest possible development under the best economic conditions, best management and lowest rates. He was glad to note the change of attitude on the part of the government toward electrical developments. Monopoly was now sought where a few years ago reports were issued against combinations and monopolies in water powers. The business, he said, was now recognized as being essentially monopolistic and all the government should do is to hold electrical enterprises in absolute public control as to rates and practices. Without a recapture clause the federal charge can be adjusted from time to time. The government, he maintained, has no values to give to any one in connection with water-power developments.

The return allowed can be secured by any one without the least effort by merely buying a bond.

The amendments offered by Senator Walsh called for the advertising of one's intention to apply for a license, giving the location of the works and the public lands to be occupied, and provided that preference be given to the applicant offering the best terms to the public.

The final hearings in the closing days of the present week were held after this issue of the ELECTRICAL WORLD had gone to press. A further report will be published in next week's issue.

"MAXIMUM PRODUCTION WITH MINIMUM WASTE"

Large Scope of the Fuel Administration Plan for Conservation in Power Plants Through Personal Inspection of Every Plant

Announcement of the appointment by the United States Fuel Administration of an administrative engineer for the Pittsburgh district as part of a general plan for fuel conservation in power plants was made in the ELECTRICAL WORLD of May 11, 1918, page 992. Thomas R. Brown is appointed administrative engineer for the Pittsburgh district and C. P. Billings special staff assistant.

This plan is the result of conferences with the federal fuel administrators and their committees for the group of states which together consume about 70 per cent of all the coal used in the United States, exclusive of railroads. The plan has received the indorsement of the fuel administrators of all these states, as well as approval of the United States Bureau of Mines and a committee representing the Engineering Council of the four national engineering societies.

The slogan of the campaign is "Maximum production with minimum waste." In other words, the object is to operate all industries at full capacity, but at the same time to make a pound of fuel perform its maximum service in power, light and heat.

In laying the foundations for the organization it has been anticipated that this work should become a permanent service of the government.

The expectation of the Fuel Administration is that from 10 to 20 per cent—that is, from 25,000,000 tons to 50,000,000 tons of coal per year—can be saved by the correct operation of steam power plants, using their present equipment, in the industries, in office buildings, hotels, apartment houses, etc.

It is considered most important that all existing fuel-conservation committees, committees of chambers of commerce and national defense, manufacturers' associations and other bodies be continued in full force, and that the work of such organizations be consolidated with the national program, which comprises certain fundamentals, as follows:

1. Personal inspection of every power plant in the country.

2. Classification and rating of every power plant, based upon the thoroughness with which owner of said plant conforms to recommendations.

3. Responsibility of rating the plants will fall upon an engineer in each district, the rating to be based upon reports of inspectors, who will not express opinions, but will collect definite information. The state fuel administrator, in his judgment, may entirely or partially shut off the consumption of coal to any needlessly wasteful plant in his territory.

4. Inspectors are to be furnished from one or more of the following sources: (*a*) Inspectors of the steam-boiler insurance companies; (*b*) state factory inspectors; (*c*) engineering students from technical colleges; (*d*) volunteers.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in class 1, 2, 3 or 4.

The ratings will be based upon existing equipment. The difficulty, delay and expense involved in the installation at this time of improved power equipment is fully recognized, but experience has proved, in the judgment of the Fuel Administration, that 10 to 20 per cent of fuel now used in power plants can be saved by improvements in operation alone.

In advance of the first inspection a questionnaire will be sent to every power plant in each district, with notice to the owner that within sixty or ninety days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will tend to prepare the minds of plant owners for what will follow. It will operate to induce proper care in furnishing information and will also tend to produce a desire to improve their plants, if necessary, so that they may be rated in a high class by the time the inspector calls upon them.

COLLECTING WAR DATA FOR N. E. L. A. CONVENTION

Information Sought from the Companies as to Employees in Service, War Loans, War Savings Stamp Activities, Etc.

Secretary T. C. Martin of the National Electric Light Association, writing to electric light and power companies, says that in connection with the thirty-fourth annual meeting of the association, to be held at Atlantic City on June 13 and 14, it is desired to present definite data bearing upon the direct relations of the electric light and power industry to national service in the various forms that represent contribution toward winning the war. It is known in a general way, he says, that, "as was to be expected, the response of our group of public utilities to all patriotic and philanthropic appeals has been both prompt and generous, but no details exist as to present conditions and results.

"The value and need of such information is obvious, and I have been instructed by President Lieb to make this effort to secure it, with the request that you will immediately co-operate with us. The belief is entertained that each company has in its possession already information of the kind sought, as proved by the inquiry made by us at the time of the first draft in regard to its effect on the man power of the industry."

Data are specifically requested as to four main items: (1) Number of employees in all the armed forces of the nation; (2) contributions to war loans; (3) war savings stamp activities; (4) Red Cross work and allied patriotic philanthropy.

Already returns are being received at the association offices, and some of them are surprisingly large.

SEEKS TO POSTPONE RATE CASE UNTIL TERMINATION OF WAR

Edison Electric Illuminating Company of Boston Makes Earnest Effort to Convince Commission that This Would Be Right

A vigorous plea on behalf of postponement until the end of the war of the pending general inquiry by the Massachusetts Gas and Electric Light Commission into the rates of the Edison Electric Illuminating Company of Boston was made May 9 by F. M. Ives, counsel for the company. The board was hearing the petition of Granville S. MacFarland of the Hearst publications for a rate investigation on the Boston system, when Mr. Ives requested that the whole matter be tabled without prejudice during the remainder of the war. After listening to the company's side and reserving an opportunity for President C. L. Edgar to make a statement later, the commission adjourned the hearing to May 13, when the petitioners were to reply to the suggested postponement.

THE REASONS FOR POSTPONEMENT

The company assigns as grounds for its motion three reasons:

The improbability of the commission's recommending a general decrease in rates or a revision of schedules at this time, and the much greater probability of the necessity of an increase in rates if the company is to continue an efficient servant of the public.

The fact that the company has neither the time nor the funds necessary for a proper preparation of the case, either in getting at the facts which the petitioners desire or for a proper presentation of its own case.

The futility of an investigation of the facts upon which a proper measure of the rates should be based when the facts are changing daily.

The Boston Edison company finds itself in the same predicament as other companies in the same field. It has already felt obliged to add to its rate a coal clause designed to collect from all its customers the exact increase of the cost of coal above the cost in normal times. So far this coal clause has not been applied to the maximum rate, with the result that the company is not collecting anything like the increased cost of coal. The company foresees the time when the coal clause must be applied to the maximum rate, and if conditions do not change for the better, it seems inevitable that a general increase in rates will be necessary. The amount written off for replacements last year exceeded $200,000 transferred to the reserve fund for that purpose.

As a result of the street-lighting decision the company has been obliged to pay back to the city of Boston for the period from December, 1914, to February, 1918, both inclusive, almost $150,000. By agreement with the city the company is paying this in ten monthly installments, paying interest on the installments from March 1. The new street-lighting rates have been made effective all over the system, with a reduced income of from $50,000 to $60,000 per year. Lightless nights during January, February and March and heatless and workless days during the same period still further reduced the income by some thousands of dollars. The Boston company now estimates that daylight saving will reduce its income at least $250,000 a year.

Last week a general increase of 10 per cent was granted in the wages of all employees earning $3,000 or less, a concession which will cost the company at least $200,000 a year. Increases in the cost of coal, a small percentage of which is compensated by the coal clause, amount now to $1.65 per ton (55 cents on the coal price and $1.10 on the transportation) above the price paid in the fiscal year 1917, and the company burned 225,000 tons in that year. The consumption has since increased and further advances in coal cost may be expected, together with higher prices on materials for repairs and renewals. The $875,000 available in 1917 for depreciation and surplus looks small in the face of 1918 requirements and will virtually disappear in 1919 if the war continues and rates are not increased.

Mr. Ives pointed out that there is a severe shortage of the men needed to prepare a rate case properly. Prof. D. C. Jackson, who has been at work on this case for the company for several months, has been summoned by General Pershing to France, and the government has commissioned W. B. Jackson, his partner, withdrawing him from private practice. The company's own officers are so occupied with work of public concern that little time is available for other than routine business. President Edgar's service on committees, important not only to the industry but to the government, requires his attendance in New York or Washington two or three days in every week, leaving him little time for other than routine affairs, many of which are unusual in scope.

Conditions are far from ordinary. Costs are changing daily, and the only inference which can be drawn from past costs is that they will be higher to-morrow if the war continues, Mr. Ives states.

THE SERIOUS FUEL SITUATION

The company has a contract for transporting coal from Hampton Roads to the boiler room at South Boston at 95 cents per ton. This has already been increased to $2.05, and the company has conceded that a further increase not yet settled is to be met. If the government should withdraw the boats it has already requisitioned, there is a probability of having to pay the government rate, which is $3.23 for freight alone from Hampton Roads to South Boston. It is said that this rate has now been raised to $3.50. In February, when the supply was low, the company paid about $9 per ton for a cargo of coal at the wharf bought outside the contract. If the coal shortage continues, as seems more than likely, there will be more than a few months of lightless nights and heatless and workless days next winter, with a resulting loss of income. If the government continues giving in to the ever-increasing demands of labor, the company will be forced to make further increases in wages. To-day 310 employees are with the colors.

In closing, Mr. Ives said: "The company has to face the very serious problems caused by the existing ever-changing conditions, due to the most stupendous war in the history of the world—problems which are the most serious in the experience of the company. It asks that it be permitted to attend to their solution, untrammeled and unimpeded by proceedings to reduce its rates instituted when conditions were normal and before a war in which the United States might take so important a part was thought of."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Engineers' Club of Columbus.—At a recent meeting of the Engineers' Club of Columbus, Ohio, E. G. Bradbury was chosen president and E. G. Morris secretary.

Engineers' Club of Trenton.—On May 9 J. B. Scott of Day & Zimmermann, Inc., addressed the Engineers' Club of Trenton, N. J., on the new power plant of the Erie Lighting Company, at Erie, Pa.

Louisiana Engineering Society.—T. F. Carlisle, British Consul, delivered an address on "Britain and the War—The Last Twelve Months," before a meeting of the Louisiana Engineering Society, New Orleans, on May 13.

A. I. and S. E. E., Cleveland Section.—The Cleveland Section of the Association of Iron and Steel Electrical Engineers will hold its next meeting on May 25 at the Hotel Statler. A. E. Hogrebe will deliver an address on "Electric Cranes."

A. I. E. E., Schenectady Section.—"The Romance of the Pictures" was the subject of an address by C. Francis Jenkins, president of the Society of Motion Picture Engineers, before the May 10 meeting of the Schenectady Section of the American Institute of Electrical Engineers.

Detroit Engineering Society.—At a recent meeting of the Detroit Engineering Society Charles Dixson was elected president. At the May 3 meeting of the society Robert H. Kuss, consulting engineer, Chicago, spoke on the subject of "Coal Conservation as Applied to Boiler-Room Operation."

Society for the Promotion of Engineering Education.—"The Engineering School and the War" will be the subject of a discussion at the twenty-sixth annual meeting of the Society for the Promotion of Engineering Education, to be held at Northwestern University, Evanston, Ill., June 26-29.

Engineering Club of Des Moines, Iowa.—Engineers have banded together in Des Moines, Iowa, and have formed the Engineering Club. The membership includes practicing engineers, graduate engineers and non-graduates who are engaged in engineering work. The first officers are A. W. Lee, president, and Monroe L. Patrick, secretary.

I. E. S., Philadelphia Section.—"The Relation of Light to Health" was the subject of a paper read by Dr. C. E. de M. Sajous before a joint meeting of the Philadelphia Section of the Illuminating Engineering Society and the Philadelphia Safety Council on May 17. Howard Lyon also gave a short talk on "Methods of Calculation."

Jovian League, Atlantic City, N. J.—A chapter of the Jovian League has been established at Atlantic City, N. J., with A. J. Purintor as president and H. C. Stockinger as secretary. The league will hold meetings on the first and third Mondays of each month.

N. E. L. A., Iowa Section.—The date of the convention of the Iowa Section of the National Electric Light Association has been changed from May 22 and 23 to May 31 and June 1. The program is as follows: Discussion of the labor situation by T. Crawford, Clinton, Iowa; discussion on isolated plants by Austin Burt, Waterloo, Iowa; discussion on rate increase by F. A. Warfield, Peoria, Ill.; discussion on the coal situation by F. W. Linebaugh, Boone, Iowa; discussion on boiler-room economy by E. S. Hight, Peoria, Ill.

Missouri Association of Public Utilities.—The annual convention of the Missouri Association of Public Utilities is meeting at St. Joseph, Mo., May 17 and 18. The program is as follows: P. J. Kealy on "Work of National Utilities Association"; H. Wurdack, "How War Conditions Have Affected the Utilities of the State and the Nation"; J. S. Tritle, "Problem of Manufacturing Under War Conditions"; H. Spoehrer, "Taxes Affecting Public Utilities." According to an announcement of the convention issued by F. D. Beardslee, St. Louis, secretary-treasurer, the Fuel Administrator of Missouri will also address the convention.

National Electrical Credit Association.—The nineteenth annual meeting of the National Electrical Credit Association will be held at the La Salle Hotel in Chicago on June 17 and 18. The National Association of Credit Men will also hold its annual meetng at the Hotel La Salle June 18 to 21 inclusive. President W. T. Pringle of the Pringle Electric Manufacturing Company of Philadelphia will preside at the electrical credit men's meeting, and the program will be conducted under the supervision of M. A. Curran, Western Electric Company, New York, as chairman of the committee on arrangements, and H. E. Wilkins of the Belden Manufacturing Company, Chicago, chairman of the local committee of entertainment.

Arkansas Association of Public Utility Operators.—The important papers to be presented at the eleventh annual convention of the Arkansas Association of Public Utility Operators at the Arlington Hotel, Hot Springs, on May 21 and 23 inclusive, will be as follows: William Crooks, engineer Arkansas Light & Power Company, "Transmission Line Construction"; J. F. Christy, manager Jonesboro Water & Light Company, "Present-Day Fuel Situation"; A. Patterson, superintendent electric department Southwestern Gas & Electric Company, "War-Time Costs Versus Rates"; W. R. Herstein, Electric Supply Company, Memphis, Tenn., "Courteous Attention to Traveling Salesmen." W. N. Gladson, dean of the College of Engineering, Arkansas State University, will also deliver an address.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

To Improve Trade Statistics for War Work.—With the immediate object of furnishing more detailed and accurate information for the war boards engaged in licensing imports and exports and conserving tonnage, foodstuffs and raw materials, a radical revision and extension of the government's foreign trade statistical classification has been undertaken by the Bureau of Foreign and Domestic Commerce, Department of Commerce. To this end the business public is urged to make immediate suggestions as to new classes of goods that ought to be shown in the trade statistics or new subdivisions of the present classes. Although the present need for more specific statistics is largely brought about by the war, the bureau desires to make the statistics of the largest possible permanent value in its work of promoting foreign commerce after the war. The Tariff Commission, the Food Administration, the War Trade Board, the Shipping Board and other war organizations are cooperating with the bureau in the effort to obtain a more detailed classification and will take measures to insure compliance with the officially issued regulations.

Higher Rates Sought in Kansas City, Mo.—The Kansas City Light & Power Company is preparing to make application to the Missouri Public Service Commission for readjustment of schedules. The commission is now securing material on the company's costs of operation and revenue, in view of the fact that the schedule indorsed by it in 1917 was to be operative only until April 30 this year. The Kansas City Railways Company has asked the commission to increase the rate charged by it to the Kansas City Light & Power Company for energy from around 1 cent per kilowatt-hour to a figure that will provide at least for cost. It is expected, according to Kansas City advices, that the commission will grant such an increase, possibly of four-tenths of a cent or thereabouts, which would involve an additional annual expense to the light company of about $350,000. It is also possible that the commission may make the increase retroactive or may require the payment of a lump sum. If the increased rate is granted, effective from Jan. 1 this year, and a lump sum of $100,000 or more is granted for making up deficiencies of the rate during 1917 and previously, these costs, with the increased expense of wages and coal, would mean a burden of around $700,000 on the light company this year, which the schedules would have to take care of, at least in part.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Arthur E. Smith has resigned as commercial manager of the Little Rock (Ark.) Railway & Electric Company to enter the automobile business in Little Rock.

P. W. Campbell has been transferred from the Henryetta (Okla.) Electric Light Company to act as manager of the Stamford (Tex.) Gas & Electric Company.

D. F. Radsliff, chief engineer of the Northern States Power Company, Grand Forks (N. D.) division, has entered the Thirty-fourth Engineering Regiment at Wrightstown, N. J.

Robert A. Wood has resigned as new-business manager of the Brush Electric Company, Galveston, Tex., to take charge of the Christian Science army camp work in Texas.

A. L. Martin, manager of the Oregon Power Company, Marshfield division, has been elected a member of the board of directors of the Marshfield Chamber of Commerce for the ensuing year.

J. C. Breeding has been transferred from the Stamford (Tex.) Gas & Electric Company to the Longview (Tex.) Ice & Light Company to act in the capacity of manager, succeeding W. B. McNaughton, resigned.

Paul J. Hayes, formerly manager of the Texas Public Service Company of Vernon, Tex., has been appointed manager of the Henryetta (Okla.) Electric Light Company and the Henryetta Ice & Cold Storage Company.

G. C. Marshall has been transferred by the American Gas & Electric Company from the Newark office of the Ohio Light & Power Company to the Steubenville (Ohio) office of the Ohio River Power Company as commercial manager.

George M. Keenan has been appointed superintendent of the railway power plant of the Little Rock Railway & Electric Company. This appointment was called for by the resignation of A. W. Russell, formerly chief engineer of the power house.

V. L. Blanchard, who has been a special representative of the new-business department of the Toledo Railway & Light Company, has returned to the Brush Electric Company at Galveston, Tex., as new-business manager, succeeding Robert A. Wood, resigned.

A. P. C. Schramm, who for the last five years has been the chief engineer of the Klaxon Company, Newark, N. J. has established himself as a consulting engineer at 276 Canal Street, New York City. His work embraces electrical, industrial and efficiency engineering.

J. C. Chestnut has resigned as superintendent of the New Castle (Pa.) Electric Company, a subsidiary of the Mahoning & Shenango Railway & Light Company, to become general manager of the Choctaw Power & Light Company, McAlester, Okla. Mr. Chestnut has been superintendent at New Castle for the past four years, prior to that having been superintendent of the Shenango Valley Electric Light Company at Sharon, Pa.

A. G. Carson has resigned from the managership of the Eastern Wisconsin Electric Company at Fond du Lac to become associated with the C. C. Smith interests in Wisconsin.

F. E. McKenna, formerly superintendent of the Oregon Power Company at Coquille, has been transferred to Marshfield as general superintendent for the Coos Bay division of the Oregon Power Company.

C. J. Cooper, Jr., who until recently has been assistant general manager of the Merchants' Heat & Light Company, Indianapolis, Ind., has been made general manager of the Mineral Point Public Service Company, Mineral Point, Wis.

M. H. Frank has been appointed manager of the Eastern Wisconsin Electric Company at Fond du Lac, succeeding A. G. Carson, resigned. Mr. Frank, who is a graduate of Purdue, was previously with the Galesburg (Ill.) Railway, Lighting & Power Company.

F. T. Morrissey has been appointed electrical engineer for the Indiana Railways & Light Company, Kokomo, Ind., to fill the vacancy made by the resignation of George H. Losey. Mr. Morrissey was formerly manager of the Eldorado (Ill.) group of properties owned and operated by the Southern Illinois Light & Power Company.

H. W. Derry has resigned as contract agent of the Pittsfield (Mass.) Electric Company to take charge of the motor sales department of the Hartford (Conn.) Electric Light Company. Mr. Derry has been associated with the Pittsfield company for the last five years, having been in the employ of the Westinghouse Electric & Manufacturing Company previously.

L. R. Dutton, manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company, has been granted leave of absence by the company from May 1, to engage in war welfare work in connection with the military training camps. Mr. Dutton has been appointed to a secretaryship of the Y. M. C. A. at the base hospital at Camp Dix, Wrightstown, N. J.

Dr. Addams S. McAllister has gone to Washington, D. C., as assistant to Major Thompson in the progress section of the Control Board of the Ordnance Department. Prior to going to Washington Dr. McAllister had been very active in New York in engineering society committee work relative to war matters—among other things, obtaining for the government engineers with qualifications required for particular war operations.

E. G. Holzer, who for fifteen years has been manager of the Easton Gas Works, has been appointed manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company during the absence of L. R. Dutton, who has gone into war welfare work with the Y. M. C. A.

M. W. Arthur has resigned from the Westinghouse Electric & Manufacturing Company to accept a position as superintendent of sales for the Northern Ohio Traction & Light Company of Akron. Mr. Arthur for seven years has been connected with the railway and power department of the Westinghouse company at Cincinnati.

C. L. Proctor, who has been new-business manager of the Empire District Electric Company at Joplin, Mo., has been made general manager of the Danbury (Conn.) & Bethel Gas & Electric Light Company, succeeding the late Charles H. Merritt. Mr. Proctor before going to Joplin three years ago was for six years general superintendent and purchasing agent for the Athens (Ga.) Railway & Electric Company.

C. M. Brewer, manager of the Richmond (Cal.) division of the Western States Gas & Electric Company, has been appointed a member of a committee organized for the purpose of assisting the Industrial Commission in effecting a suitable building and loan plan to increase the residences in Richmond. Mr. Brewer has also been made a member of the executive board of a newly organized war body to be called "Community Council for War Work."

Ralph W. E. Donges, president of the Board of Public Utility Commissioners of New Jersey, has been commissioned a lieutenant-colonel in the National Army. Governor Edge of New Jersey has requested Secretary of War Baker to permit the continuance of Mr. Donges' commissionership until pending important rate cases are decided. Lieutenant-Colonel Donges has been a commissioned officer in the New Jersey National Guard for the last seventeen years. He has been a member of the State board since 1913, when he was appointed by Woodrow Wilson, then Governor.

Obituary

Arnold von Siemens of Siemens & Halske died last week at the age of sixty-five years, according to a press dispatch from Berlin.

Frank E. Getts, general manager of the Electrical Engineers' Equipment Company, Chicago, died May 7 in Los Angeles, as the result of overexertion, which caused an artery near his heart to burst. Mr. Getts had become well known in the electrical industry through his connection with the Siemens-Halske company for five years and the General Electric Company in the turbine department for fifteen years. At one time Mr. Getts was in charge of the turbine business of the General Electric Company in the Chicago district.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

STANDARD PACKAGES IN CERTAIN LINES OF ELECTRICAL GOODS

The Advantages and Convenience of the New System —Various Branches of the Trade Are Now Considering the Change

For some months there has been considerable attention given to the matter of the number of pieces in standard packages. There is now no general system. Some members of the trade incline toward the dozen system, while others are in favor of the tens system.

The former argue largely from the ease with which the dozen lends itself to packing. It has the four and three combination. Those in favor of the tens method point out the ease of thinking in units of ten. Where ten will make packing difficult they use a multiple of ten. This is their way out. Furthermore, that the inclination of American trade is more and more toward the use of the metric system is an argument made in favor of the tens system.

In this connection one company, the Bryant Electric Company, has already established new standard packages. The following quantities now prevail in standard packages in the Bryant line: 250 keyless socket body, 250 pendent cap, 100 ⅛-in. cap, 100 ¼-in. cap, 100 ⅜-in. cap, 100 ½-in. cap, 100 ⅜-in. angle cap, 100 ½-in. angle cap, 100 molding base, 100 3¼-in. box base, 100 4-in. box base.

MANUFACTURERS AND JOBBERS REPORT INCREASING BUSINESS

Southeastern Trade's Volume of Buying Indicates Value per Order on Higher Level— Status of Trade Acceptance

For the last two years, and during 1917 and up to the present time especially, the manufacturers represented in the Southeast, together with the jobbers, have enjoyed a large volume of business; and underlying indications point to a continuance of these conditions, with the possible exception of a marked cessation in central-station purchases. The latter are more than offset, however, by substantial buying for government account. Previous to 1917 the dealers and jobbers bought, in a measure, from hand to mouth, and along the entire line the value per order was small compared with the same value to-day. While sporadic large orders created spotty increases in these values, nevertheless the general average was comparatively low. Data at hand indicate that the value per order is increasing daily.

Utilizing 100 as a base or index figure representing the value per order for 1916, the indices for 1917 are 140 for manufacturers and 125 for jobbers. The last three months of 1917 indexed 180 for manufacturers' sales and 150 for jobbers'. From meager information the index figures for 1918 to date are: Manufacturers, 184; jobbers, 156. The greater portion of increase in these index figures is due to the fact that prices enhanced rapidly in many lines during 1917, but there are several other potent factors that have tended to boost these figures.

Dealers are buying larger quantities through the jobbers, because a smaller number of salesmen are traveling. Salesmen do not call as frequently, and then, too, dealers realize that the man with the goods secures the business. This feature alone makes for larger individual orders, which in part precludes future difficulties in transportation. Moreover, the same reasons for increased index figures are applicable to the manufacturers, as the jobbers are buying in large lots, being actuated by the same motives that influence the dealers and retailers, combined with some pressure and wholesome advice from manufacturers.

It can hardly be said that the adoption of the trade acceptance has affected the index figures, but it may be of interest along this line to state that the acceptance is being received with more favor throughout the industry. A preliminary canvass shows that while a few manufacturers are suggesting this class of paper to jobbers, others are "staying off" awaiting the trend of activity in this channel. For a time the jobbers were paying very little attention to the acceptance, but of late it has come into wider use. At the present time there is slight opportunity for the contractor to utilize this paper, owing to the fact that his accounts are harder to take care of in this manner.

SELLING TRADEMARKED GOODS IN LATIN-AMERICAN COUNTRIES

Director Appointed by Treasury Department at Havana—Long-Established Abuses in Connection with American Brands to Be Eliminated

Manufacturers and exporters selling trademarked electrical goods in foreign countries, particularly South America, may be interested in these few important facts: (1) In Argentina, Bolivia, Chile, Costa Rica, Cuba, Guatemala, Paraguay, Peru and Venezuela trademark titles absolutely depend upon priority of registration. Furthermore, any one may lawfully register a United States trademark (registered or unregistered) and thus prevent entry of the goods into the country. (2) In Brazil, Cuba, Guatemala and Panama the trademark must be registered in the United States Patent Office before it can be registered in these countries. (3) In Ecuador, Mexico and Nicaragua no suit may be brought for infringement of a trademark without registration. (4) It is said on good authority that enemy belligerents are now registering United States trademarks in countries mentioned in clause (1) through "dummies." The result is obvious: manufacturers who anticipate exporting trademarked products will find themselves blocked in their effort to do so.

At the fourth Pan-American Conference, held in Buenos Aires in 1910, a convention was adopted which provides that "any mark duly registered in one of the signatory states shall be considered as registered also in the other states of the union, without prejudice to the rights of third persons and to the provisions of the laws of each state governing the same. In order to enjoy the benefit of the foregoing, the manufacturer or merchant interested in the registry of the mark must pay, in addition to the fees or charges fixed by the laws of the state in which application for registration is first made, the sum of $50 gold, which sum shall cover all the expenses of both bureaus for the international registration in all the signatory states."

In the administration of this provision two bureaus for the registration of trademarks were to be established. The twenty-one republics forming the Pan-American Union are divided into two groups, with Havana as the center for the countries of North and Central America and the West Indies, and Rio de Janeiro as the center for the South American countries. Either bureau may be established upon the ratification of the convention by two-thirds of the countries of the respective groups. The necessary number for the establishment of the bureau at Havana were secured in August, 1916. At present Mexico, Salvador and Haiti are the only countries of the northern group that have failed to ratify the convention. Dr. Mario Diaz Yrizar has been appointed director of the bureau at Havana.

LEADING FAN MANUFACTURERS NOW POSITIVE OF SHORTAGE

Government Requirements Are Exceeding All Calculations—Selling Season Is Well Advanced and Business Is in Full Swing

So far it now seems certain that in the Eastern section of the country a shortage of fans is unavoidable. This is the opinion expressed by several leading manufacturers in reviewing current conditions and immediate prospects. Following what was stated in the ELECTRICAL WORLD of April 27, page 900, and with the premature opening of the retail selling season, two months earlier than usual, producers are more positive than ever that a shortage is in sight.

One manufacturer, conspicuous for his company's large output and important distributing connections, stated this week as an instance of the unusual, if not unprecedented, demand for fans that his concern had just received inquiry for 2000 to 3000 fans from a United States medical base and another from the government concerning the equipment of one of the biggest cantonments. Further, he said that if all the cantonments ordered on similar specifications, which is more than likely, these requirements alone would be sufficient to absorb the entire stock of fans in the country.

Shell-loading plants, a new source of distribution, are in the market for liberal quantities of fans. These buildings are hastily constructed in connection with powder and explosive factories, and if other establishments of this kind, complete and in course of construction, make similar requirements, the supply will be again heavily drawn upon. If government orders so far received are followed by others of the same proportion, it seems likely that fans must necessarily be rated as essential war merchandise.

The manufacturers are of one mind. They are equally emphatic regarding the threatened scarcity. One of the Western producers with important Eastern connections stated that up to date his sales to the close of April were equal to what were usually reached in June. Of course, it was stated, prices are fixed and will not be disturbed, but they in no way are binding on the dealer.

METAL MARKET SITUATION

Official Price of Copper Still in Abeyance—Scarcity of Tin Causing Concern

Some manufacturers and jobbers of electrical staples and wire products are positive that copper will be placed on a higher official price level June 1. With this belief increases in the cost of finished goods are spoken of as assured. Nevertheless, the War Industries Board has come to no decision, though a number of conferences have been held to discuss the matter. Metal market authorities are equally certain no change will be made. Tin is occupying more attention than copper, its scarcity inducing the government to inquire into conditions. The increasing shortage and high prices are causing acute concern in the electrical trade.

NEW YORK METAL MARKET PRICES

	May 6	May 13
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price	7.00	7.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	7.10 to 7.12½	7.45 to 7.57½
Tin, Chinese*	$1.00	1.05
Aluminum, 98 to 99 per cent.	Govt. price †32.10	Govt. price †32.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.50	10.50 to 11.00
Lead, heavy	5.75 to 6.00	5.75 to 6.00
Zinc, old scrap	5.50 to 5.62½	5.00 to 5.50

*No Straits offering. †In 50-ton lots; carload, 32.10 cents per lb.; 10-ton to 14-ton lots, 32.20 cents per lb.

THE WEEK IN TRADE

NO UNFAVORABLE reports concerning general business in the electrical trade have been received in the past week. On the contrary, sales have increased in volume and value, and, on the whole, a more cheerful aspect is noticeable in every section. Jobbers' stocks are in better shape, far-sighted buying, predicated on a belief in the underlying soundness of commercial affairs, being responsible. Dealers are also anticipating their requirements and making needful preparations for future demands by the consumer. In some parts of the country it is estimated that the volume of trade is 50 per cent ahead of last year, and would be still greater if the shortage of labor had not curtailed production and hampered work in which electrical equipment would have entered largely.

Price advances of a substantial nature are said to be about ready for announcement in schedule material, porcelain goods, etc. Lamp stocks are now well distributed, and even an accumulation is mentioned in some places heretofor complaining of a shortage. Conduit is yet difficult to obtain in quantity. Domestic items, such as sewing and washing machines, ironers, flatirons, etc., are selling 25 per cent ahead of last year at this period.

Collections are somewhat slow, especially with the contractor-dealer class, which is inclined to overbuy. Accounts are carefully watched, particularly on new business.

NEW YORK

No falling off in the demand for electrical goods is reported. On the contrary, manufacturers are having a full quota of orders from distributers and jobbers, with the dealers absorbing whatever is obtainable in staples and specialties. Some price changes have been announced on insulation where cotton, linseed oil, etc., figure, and advances are said to be imminent in lines in which copper and brass are basic materials.

Deliveries improve not uniformly, but unevenly, the embargoes occasionally lifting temporarily and permitting the shipping and arrival of goods sometimes delayed for weeks en route. Labor is causing anxiety at the factories, shortage of skilled workers interfering seriously at times with their productive capacity.

Collections are reported as slowing up within a week or two. Credits were never so carefully watched.

SCHEDULE MATERIALS.—An advance of a substantial character on schedule materials—outlet boxes, standard sockets and receptacles, rosettes, shade holders, etc.—is about ready to be made by manufacturers whose lines are handled by almost the entire jobbing trade. The last increase was announced in November, when the discounts were lowered from 47 to 40 per cent. The impending change is credited to the difficulty of obtaining material, shortage of labor, the large investment required to carry on business and other considerations. On these goods buyers are advised to place orders early if reasonable deliveries are desired. Several carload shipments, held up for weeks en route, were received last week, easing the supply.

COLLECTIONS AND CREDITS.—Reports are to the effect that collections have fallen off about 5 per cent recently. No special cause is assigned.

FRACTIONAL MOTORS.—Small motors for sewing and washing machines, ironers, etc., are still coming through slowly. The demand exceeds all previous records.

LIGHTING FIXTURES.—Trade is quiet and has been for some time, owing to the slump in building operations. Some jobbers and dealers are having clearance sales to stimulate business, using discontinued styles as a price lever, shading prices to meet the varying circumstances presented. Such

other sales as are recorded are for replacements and improvements.

WIRING DEVICES.—Of the great variety scheduled the dominating orders are coming through governmental departments for war industries, material and equipment. These requirements are so large that only the manufacturers are thought to be able to handle them successfully, making deliveries in accordance with specifications. The orders are divided or distributed by a government representative in the electrical field, so that the different factories are treated on a capacity basis.

CONDUIT.—Distributers state that conduit is somewhat easier in all sizes for commercial demands. Freight embargoes are still hampering deliveries from the mills, which are reported to have an ample stock. Substitutes, made with less steel and having other claims to the trade's attention, are appearing in the market and being generously exploited. Prices remain firm on the regular lines.

CHICAGO

The volume of business in the Chicago territory continues to be fairly good, but evidence of the spotty characteristics formerly mentioned are still present. The week's news carries indications of improvement in future business. The Chicago Telephone Company has gone before the City Council asking a rate increase. With the People's Gas Light & Coke Company already asking for increased rates, this makes two out of Chicago's four important utilities applying for more revenue. The position of the Commonwealth Edison Company remains unchanged. It is buying resale merchandise for its electric shops and is making purchases of such materials as meters but there is no general buying movement or buying for construction.

In the industrial field the news that the United States Steel Company will build a great gun plant in the Middle West is taken to mean real business. Following such an enterprise there are always allied activities that provide orders for the entire trade. Not much electrical business is expected to result from the freight-car orders that have been placed in this territory, because freight cars carry no electrical equipment and the building of them is largely done outdoors so that very little factory electrical material is needed. There have been no price changes during the week, but certain changes, it is expected, will be announced soon.

PORCELAIN.—Contracts for porcelain are now being written with a provision for a price revision on July 1. This applies to the so-called standard lines and special products. It does not appear likely that it will affect high-tension insulators. That the price revision will be a revision upward, if it is made, appears unquestionable in the light of the labor and fuel situation in the porcelain production fields.

CONDUIT.—There is no improvement in the conduit delivery situation. Jobbers report that they are obliged to fight for every dollar's worth of conduit they get. The government is taking more and more of this product, and the situation appears likely to become worse.

COPPER WIRE.—The increase in the price of weatherproof wire has made no appreciable change in the business situation. Surprise is expressed that it did not go higher, and the belief has been put forward that manufacturers who have not raised their prices will very soon be obliged to do so.

METERS.—Two important meter factories in the Middle Western territory report that their business is holding up well as to volume. While this is somewhat surprising in view of the curtailment in residential building activities, it can be accounted for by the exceptional activity in industrial building.

INDUSTRIAL LIGHTING EQUIPMENT.—In spite of the daylight-saving law this class of apparatus is moving actively.

SPECIAL WIRE.—Local manufacturers of enameled and other special wire report that the factories have practically all the work that they can handle, but that fairly good deliveries are being made.

ELECTRIC RANGES.—Sales so far in 1918 are just about equal to what they were in 1917 at this date.

RESALE MERCHANDISE.—The business in resale merchandise continues good and gives promise of getting better. Jobbers report the volume in this class of goods to be far ahead of what it was this time last year. Not enough washing machines are available to meet the demand.

BOSTON

Trade holds up well, with the usual government basis of activity in evidence everywhere. Despite widespread complaints of poor railroad deliveries, due to embargoes and congestion, jobbers' stocks are, on the whole, in good shape to meet present requirements. There has been a great deal of far-sighted buying in past months predicated on a firm belief in the underlying soundness of the business situation in this part of the country. Governmental scrutiny of the expansion of public utility facilities is very close, and the deflection of equipment for central-station use into other channels is rather disquieting, as in the case of the Boston Edison company, which, it is said, must let go of a turbo-generator of some 35,000 kw. rating, ordered some time since, and now destined for government service.

Such events do not mean disaster to the central stations, but they indicate that everything is to be run close-hauled for the immediate future, with a sharp control of new business developments. Readjustments are constantly taking place as the war progresses, but there is no reason to expect the electrical buying power of New England to shrink to the starvation point because of these changes. Large orders for electrical material are going into the army and navy base work in this part of the country, and more are to follow. Competition is keen, and there is some complaint that these large orders are not so widely distributed as is desirable under present conditions.

SOCKETS AND SWITCHES.—An advance of from 10 to 15 per cent in prices on P. & S., Bryant, Hubbell, etc., schedule B and schedule S material, was expected on Monday and is likely to be in effect by this time.

COLLECTIONS.—These are fairly good, although somewhat slow among the contractor-dealer class, which seems to be laboring under a slight tendency toward overstocking. Accounts are carefully watched in these days, especially in connection with new business.

FANS.—Everything is ready for a record-breaking business in fans. Shipments are still coming into the jobbers' stockrooms, and even central stations which are pursuing a very conservative policy commercially are now ordering fans. The mill trade in fans, both for office and departmental service, looks unusually promising, and many industrial managers appear to realize to-day that the humble electric fan is a factor in hot-weather production not to be neglected.

FUSES.—A steady market is reported, with substantial sales to mill customers. Prices hold firm on various types.

ELECTRICAL SUPPLIES FOR AUTOMOBILES.—Business is very active. One jobber sold more than $500,000 worth of automobile accessories, including much electrical material, last year. Stocks are in good condition and the outlook is excellent for the season.

FLASHLAMPS AND DRY CELLS.—A steady business is reported in the former, with a heavy absorption of product by cantonments and naval stations. Dry cells are in much demand by the garage trade.

ELECTROMAGNETS.—Large magnets for lifting service are in steady demand after a distinct "peak load" in sales last year, due to an apparent sudden realization of their economic value. A new field of service appears to be marine reclamation.

HEATING EQUIPMENT.—To offset a present quiet spell in domestic heating demand a very active period in specialized industrial electric heating applications is reported under way. The saving of time and insurance of high-quality production are strong points of interest under war conditions, and a broadening market is expected to develop. Prices are remarkably steady, considering changes in other lines.

ATLANTA

With the government operating in practically every essential line, general trade, while still heavy, has been subjected to further repression. The recent pledge of leading manufacturers to subordinate all other demands to government requirements makes for closer application to war business in the steel industry than at any previous period. It has been suggested that a continuous sixty days' run on government orders would make it feasible to give commercial needs more attention later. This idea has not received much encouragement, however, as summer operations must provide against any possible fuel and car shortage next winter.

Numerically orders are less than this time last year, but on the other hand the amounts are much greater, which indicates that the general volume so far is holding up, with big increases in some lines. The concrete ship is meeting with more favor, and it is reported that the United States Shipping Board will establish several additional plants at Southeastern or Gulf ports where the all-around climatic conditions are more favorable for this class of construction. The Bon Air Coal & Iron Corporation will erect a plant costing $1,300,000 at Lyles, Tenn., for the extraction of methyl alcohol and acetate of lime, machinery alone to cost $500,000.

LAMPS.—Stocks are well distributed and accumulating at certain points. The latter feature is due to the fact that manufacturers and jobbers are stocking up, anticipating the fall trade. The demand for lamps is excellent for this season and considerably over the same period of past years. The call appears to be general from all sections, mostly through small dealers. Industrial requirements have fallen off.

CABLE.—Factory stocks are reported to be in better shape. Local stocks, however, are in fair condition only, owing to embargoes and general transportation difficulties. The demand for heavy sizes has dropped off perceptibly at the same time that a sag in rubber is noted.

BELL-RINGING TRANSFORMERS.—Viewed through the eyes of the manufacturer the call for these is spotty, but jobbers and dealers report a steady demand. Shipments are coming in in sufficient volume to handle the volume of trade.

INSULATING MATERIALS.—A good market exists for varnished cambric, cloth and varnish. On the surface it would appear that less of this material is being used, but large quantities are utilized by repair shops and for manufacturers opening up shops for the repair of their own products. Mica and asbestos are the only materials slow in arriving.

FANS.—The arrival of seasonal weather has stimulated the movement of fans. The greater part of the shipments are being made to extreme Southeastern points. Stocks are ample.

SEATTLE

Northwest jobbers and dealers report a steady volume of sales during the past week, which is not unusual. There was no startling increase along any particular line. The past month's volumes were sustained. Labor shortage still defies solution and is hampering greatly. Shortages of conduit, rubber-covered wire and larger-sized lamps still prevail. This condition is practically conceded to be chronic. Domestic appliance sales are keeping up well. Government and shipyard sales show a very slight decrease.

Several of the largest Seattle electrical retailers rport that domestic business for April exceeded in volume that of the same month last year by more than 50 per cent. The volume would be 100 per cent greater if mechanics could have been secured to build houses. Business in fixtures, wiring devices, lamps, bells, etc., has been exceptionally heavy in the past month with no let-up in sight until the summer camping season starts.

Domestic sales in vacuum cleaners, washing machines, sewing machines, irons and smaller appliances exceed those of last year at this period by more than 25 per cent. Central stations and larger retailers report sales of ranges very satisfactory. Retailers report that commercial sales to other business houses show a heavy decrease over last year. This is due to the small amount of remodeling and new work in the business district. Wholesalers and jobbers report that sales of the larger size motors and power apparatus have decreased noticeably in the past two weeks. In fact, the supply is practically equal to the demand.

Wholesalers and jobbers at this time are realizing on heavy orders placed some time back. The past week's volume was gratifying, being somewhat heavier than for several weeks. Stocks are fairly well filled, although they are not pre-war stocks. Prices are holding steady, and shipments from the East are coming through in satisfactory shape, everything considered. One lesson has been thoroughly learned apparently by the Pacific Northwest jobbers and wholesalers, and that is anticipating future needs and demands and making preparations to care for them. Heretofore sales depended more or less on the question of deliveries. This factor is being eliminated by the dealers' foresight when possible.

A majority of the jobbing houses report lamp stocks in fair shape, although larger sizes are hard to obtain. The demand is steady and prices are firm. The diversion of thousands of cars from the East to the Pacific Northwest has overcome the shortage of equipment. There is now a surplus of cars for shippers' needs in Oregon and Washington, due to the inability of the lumber mills to load as fast as cars can be delivered.

SAN FRANCISCO

Country orders continue normal. They are composed of articles of staple call. City business, however, has been very quiet for the past week because of the National Electric Light Association convention at Del Monte. The real estate market records a number of sales of lots in San Francisco for industrial purposes. Several de luxe trains are to be taken off the Western sections of transcontinental lines. This will relieve needed hauling stock and trackage for freight shipments. That shipping conditions are being gradually improved is indicated by the resumption of twenty-day and thirty-day service between the Pacific Coast and Eastern points. Some factories are apprehensive of the government's declaration that it will shut off fuel oil from non-essentials, but California would be little affected by this order. Oil is to be diverted from the Pacific Northwest for California power companies.

The government is to construct a large number of new buildings in Camp Fremont to increase the camp's capacity to handle a second division. Thirteen acres of land have been purchased near San José on which to erect a vegetable and fruit cannery. Its cost is estimated at $250,000, and it is said that it will be the largest of its kind in the United States. Fresno reports the construction of thirty-one bungalows at an estimated value of $2,000 each. The Union Oil Company is to construct a large group of workmen's houses near Oleum. San Francisco building permits for April total 355 (of which 284 are alterations), totaling $694,000. For the same period Oakland reports 240 (76 being alterations) at an estimated value of $593,000.

The San Joaquin Light & Power Corporation is building fifty new lines to supply pumping plants with power. At present there are 225 plants connected up, and there is a heavier load at present on the substation than at any time last year. There is no assurance of power being supplied under the new applications for contracts, owing to the difficulty in securing transformers and the scarcity of labor.

GUARDS.—There were several industrial demands for low-priced portable guards during the past week. Vapor-proof and watertight guards are sold as fast as they are received from the East. The heavy duty demands and character of help supplied in the new war work factories, especially shipyards, demands absolute protection of all lamps.

CARBON LAMPS.—There was an export inquiry for 10,000 moving picture carbons to be the first shipment of a far larger quantity.

SCHEDULE MATERIAL.—Is still advancing in price. Plug cutouts, entrance switches and fuse plugs have just advanced about 10 per cent. Demand is below normal.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to $97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to $126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to 24 cents
1/5 to std. pkg	20% to 19 cents
Std. pkg.	34% to 18 cents

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	12% to + 20%
1/5 to std. pkg	List to 20%
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	List	15% to $69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List	15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00-$55.00	$20.50-$24.45	$20.00-$21.50
1/4-in.—	$28.00-$60.00	$22.50-$27.00	$22.00-$23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$36.00-$55.00	$25.00	$22.50
1/4-in.—	$40.00-$60.00	$27.00	$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Cards No. 38 and 39

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12%	7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	5.3% to 8.9%	8.3% to 11.9%
2500-5000 lb.	7.3% to 10.9%	10.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00
1/5 to std. pkg.	4.50

Standard packages, 500. List, each $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard packages, 500. List, each $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½-in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾-in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅝-in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg. ..... List
Std. pkg. 10%

DISCOUNT—CHICAGO

Less than std. pkg. ..... List
Std. pkg. 10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00 to $34.90
Coil to 1000 ft.	26.20 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100 ..... $24.00

CHICAGO

Net per 100 ..... $21.75 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½ 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. 10%
1/5 to std. pkg. 20%
Std. pkg. 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 10%
1/5 to std. pkg. 20%
Std. pkg. 30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 26.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to $11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. ..... List
1/5 to std. pkg. ..... 15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg. ..... 24% to 25 cents
1/5 std. pkg. ..... 30% to 23 cents

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100 amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low-Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	10% to 11%
$25 to $50 list	14%
	Low-Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. ..... List
1/5 to std. pkg. 15%
Std. pkg. 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. ..... List to + 20%
1/5 to std. pkg. ..... List to 15%
Std. pkg 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to 40%	List to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price $6.00
Discount 30%

CHICAGO

List price ..... $4.50 to $6.00
Discount ..... 25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.41¼-$0.44¼
No. 18, full spools	0.36¼- 0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-$18.00	$12.50-$13.00	$9.85-$11.50
12	23.25- 25.40	21.30- 21.80	15.95- 19.35
10	32.40- 35.20	29.70- 30.20	22.10- 27.00
8	45.70- 49.15	41.90- 42.10	30.85- 38.00
6	72.40- 77.85	66.35- 66.75	48.95- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00	$11.50
12	25.33-$26.28	22.02-$25.33	18 55-$20.93
10	30.49- 36.54	27.94- 31.26	22.86- 29 23
8	42.54- 51.57	38.99- 44.13	31.90- 41.36
6	61.46- 88.38	56.15- 75.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $36.40
25 to 50 lb.	34.40
50 to 100 lb.	30.40 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.42 to $40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Grill with Rust-Proof Pan

A four-heat round grill equipped with rust-proof aluminum pans instead of nickel-plated steel pans is being marketed by Landers, Frary & Clark of New Britain, Conn. The device is known as E 986 and is the same as type E 984 with the exception of the

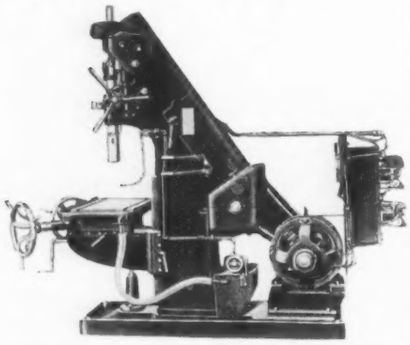
PANS ARE DETACHABLE AND MAY BE USED SEPARATELY

aluminum equipment. The manufacturers claim that these pans will withstand long boiling and soaking in water without damage because they are made of seamless aluminum. The pans may also be purchased separately.

Motor-Driven Drill and Tapper

A heavy-duty drill and tapper that eliminates the use of belts has been placed upon the market by the Barnes Drill Company, Inc., 830 Chestnut Street, Rockford, Ill. With the exception of a spindle sleeve and cross-arms all bearings and all gears are continuously lubricated by an automatic self-oiling system. The oil for this purpose is pumped from the reservoir at the base of the machine by geared pumps.

Eight changes of speed are provided

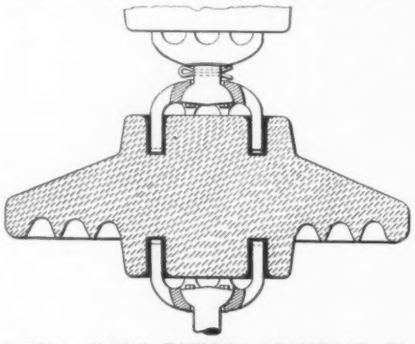


BEARINGS AND GEARS LUBRICATED BY AUTOMATIC SYSTEM

with control levers within easy reach of the operator from his position in front of the drill. For tapping the machine may be equipped with an automatic reversing mechanism which is very desirable, especially for depth tapping. The trip on this mechanism can be set so that the instant the tap reaches the depth required the spindle will automatically reverse. These machines are driven by Westinghouse Electric & Manufacturing Company 10-hp. direct-current motors by means of a silent chain. A Westinghouse automatic starting panel, which may be entirely inclosed in a metal case, is also provided with this machine.

High-Tension Disk Insulator

A high-tension porcelain disk insulator that is said to be free from internal defects is shown in the accompanying illustration. The electrodes of the insulator are separated by 2.25 in. (5.7 cm.) of homogeneous porcelain, which is somewhat more than in the case of the ordinary insulator. A metal alloy is used to fasten the electrode to the porcelain instead of cement. The manufacturers claim that

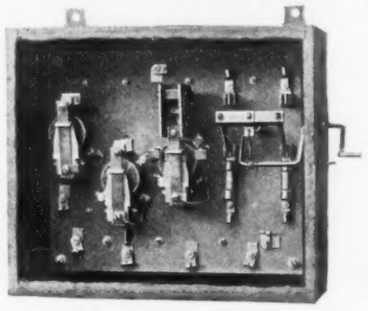


METAL ALLOY FASTENS ELECTRODE TO PORCELAIN DISK

this alloy has a flexibility sufficient to withstand all temperatures, and that it will not crack the porcelain in hot weather. The quality of porcelain is said to be of the best, and porosity is entirely eliminated from the product as far as any test will detect. The insulator is known as the J-D insulator and is manufactured by the Jeffery-Dewitt Company of Detroit, Mich.

Automatic Starter for Industrial Motors

The advantages of automatic control for machine tools have been so persistently preached by the motor and control manufacturers that it is doubtful if there remain many operators who are not fully convinced that this type of control is both economical and productive. The complete controller shown herewith is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is entirely inclosed in a dust-proof case, 15 in. high by 17 in. long by 10 in. deep (38 cm. by 43 cm. by 25 cm.), and may be locked to prevent unauthorized persons from tampering with the switches. The knife line switch is operated from the outside of the case by a crank handle extending



AUTOMATIC CONTROL INCLOSED IN STEEL BOX

through one end, thus isolating the operator from current-carrying parts. The counter-emf. method of acceleration is used, and as the time of acceleration is dependent on the motor load, positive protection against too rapid acceleration is assured. Provision is made for either conduit or open wiring through the top, bottom and end of the case opposite the switch handle. These starters are provided with protection against the failure of power and may be so arranged that either the motor will be started again when the power returns or will require the service of the operator to start it. By using pressure gages or other automatic devices in connection with these starters automatic service may be obtained.

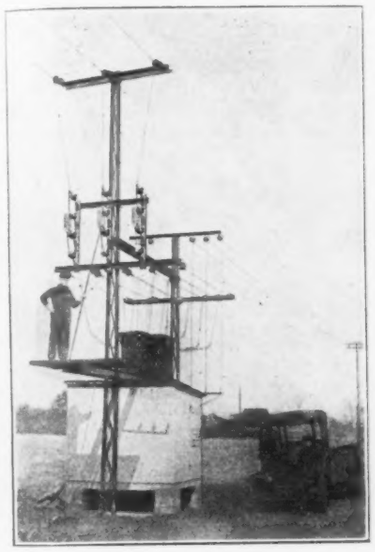
Unit Shade Connector

A unit shade connector that allows a convenient method of installation of a two-piece lighting fixture is being marketed by the J. H. White Manufacturing Company, 111 North Third Street, Brooklyn, N. Y. The connector consists of a chain with a rosette attached to each end. It is designed for units having ⅜-in. (0.95-cm.) slip holes. Three connectors are usually needed for attaching each unit, and they can be installed without the use of tools.

Ready-Made Outdoor Substation

Transmission-line companies selling small amounts of power from high-tension lines are often confronted with the necessity of designing small substations of such cost that the revenue obtained therefrom will justify the in-

stallation. To eliminate the usual drafting-room expense that has to be assumed by operating companies, the Delta-Star Electric Company, 2433 Fulton Street, Chicago, has placed upon the market a ready-made outdoor steel-frame substation that can be shipped complete for immediate erection. These standardized substations are primarily designed for voltages up to and including 33,000 and are made in various kva. ratings. When small transformers are used they are mounted on a platform, but larger ones are mounted on the ground level. High-tension switching, fusing and choke-coil equipment consists of self-contained units with channel bases for bolting to the steel frame. Lightning arresters can be mounted upon the same structure or on the next line pole ahead of the station. The type "VB" form 18 substation is shown in the accompanying illustration.



STANDARDIZED STEEL SUBSTATION SHIPPED COMPLETE

Electric Washing Machine

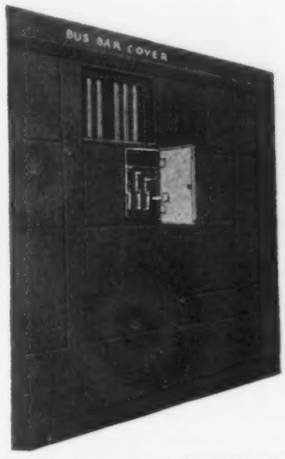
An electric washer is being manufactured by the Richmond Cedar Works, Richmond, Va., of the dolly type and made of seasoned hardwood. It is equipped with a reversing wringer with a safety release device. The moving parts of the machine, such as gears, are inclosed in steel covers for protection from dirt and against accidents. It is driven by an Emerson motor.

Receptacle Clusters for Table Use

Receptacle clusters that can be set on the dining-room table and used for supplying energy for cooking utensils are being marketed by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago, Ill. They are constructed by using a Benjamin wireless cluster that is inverted and set upon the table. The plug at the top is connected to the dining-room lighting fixture, and the energy supply is distributed from the receptacle to toaster, chafing dish or percolators that are used on tables. These devices are made in two styles, with either the two outlet or the three-outlet receptacle.

Unit-Type Safety Switchboard

Absolute safety to workmen operating switches, renewing fuses or working around switchboards is provided in an auto-lock switchboard which has recently been placed upon the market by the Krantz Manufacturing Company of Brooklyn, N. Y. The switchboard is interesting in the fact that each switch is in a separate compartment. Each of the smaller sections represents a switch unit, and each of the larger sections represents a compartment for busbars, wiring gutters and pull box. Nothing is mounted on the front of the switchboard except the switch handle and a card holder to indicate the circuits controlled by the switch. Since the switch handle is not connected with any current-carrying part, the front of the board is absolutely safe. On the back of the board, too, no live parts are exposed. If all the switches are closed so that the fuses are alive, all the fuse doors are automatically locked. If it becomes necessary to remove a fuse, the switch affected is thrown off when the switch door is open. It is also impossible for one man to close a switch when another is renewing the fuses. The door must be closed tightly before the switch can be thrown off and the fuses energized.



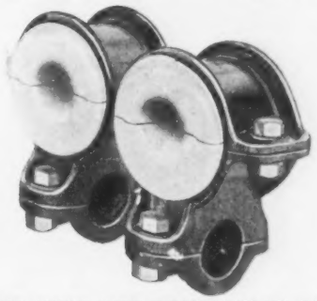
FUSE DOOR MUST BE CLOSED BEFORE SWITCH IS ENERGIZED

Cabinet Bushings That Snap into Place

A metal bushing for use in knockouts, gutter linings of cabinets, meter loops, drop-cord covers and signs has been developed and will be soon placed on the market by J. J. Duck, 432 St. Clair Street, Toledo, Ohio. No spring or locking device is necessary as the bushing snaps into place like a glove fastener. Metal bushings are said to be more efficient than porcelain.

Heavy-Clamp Insulator Supports

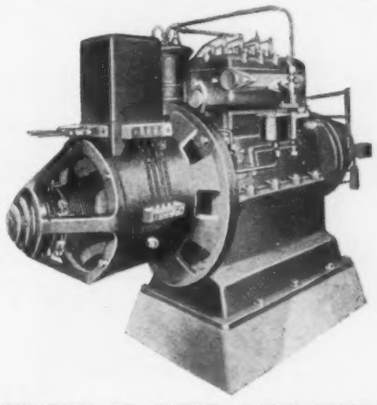
A line of insulator supports of considerable strength has recently been brought out by the General Devices & Fittings Company, Mid-City Bank Building, Chicago. The line of supports has a great number of mounting arrangements and almost unlimited size ranges. They are of the split-clamp type and may be mounted on flat or round pipe surfaces. The standard pipe-mounted bases are listed for a 1.25-in. (3.18-cm.) support, as this size is used almost universally, but bases of any size can be obtained if desired. The insulators may be used for bare or insulated conductors.



CLAMP INSULATOR THAT MAY BE EASILY INSTALLED

Farm Lighting Plant Without Battery Equipment

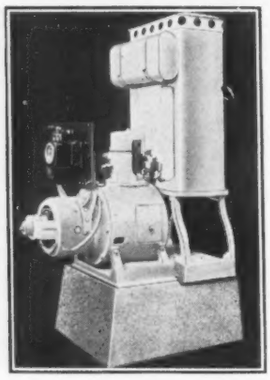
A farm lighting plant that is not equipped with a battery has been brought out by the Electromatic System Company, 2136 Michigan Avenue, Chicago. It is entirely automatic and is designed for use on the farm or in the suburban home, in public garages, stores or theaters, or in any place where light and power are needed. It delivers 115 volts direct current from the generator and is started by the turning of the switch at the point where electricity is to be used. It will remain in operation until the entire load has been removed. The plant is made in two sizes. The 1-kw. plant is equipped with a two-cylinder engine and weighs 375 lb. (170 kg.) packed complete for shipping. The 3-kw. plant has a four-cylinder engine and weighs, packed for shipping, 475 lb. (215 kg.)



OPERATION OF OUTFIT AUTOMATICALLY DEPENDS UPON LOAD

Farm Lighting Plants

The Gile Tractor & Engine Company of Ludington, Mich., is now marketing through the Consolidated Utilities Corporation, 221 Lake Street, Chicago, a 600-watt farm lighting plant. The engine is a 2.6-in. by 3.5-in. (6.7-cm. by 8.9-cm.) valve-in-head, four-cycle, water-

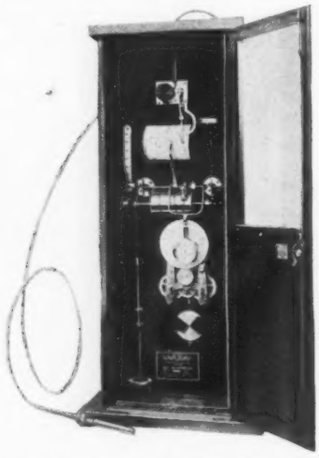


SET USES KEROSENE OR GASOLINE

cooled, 1600-r.p.m. unit. The generator operates at 32 volts to 40 volts. The plant is fully equipped, including a special governor and an arrangement to use kerosene if desired. The Consolidated Utilities Corporation has stated that the marketing of this plant will in no way interfere with the sale of its 1-kw., 2-kw., 5-kw. and 15-kw. Matthews automatic plants.

Feed-Water Weight and Temperature Recorder

The feed-water weight recorder manufactured by the Yarnall-Waring Company, Chestnut Hill, Philadelphia, which was described in the July 4, 1914, issue of the ELECTRICAL WORLD, is now being equipped with a temperature recorder. The recording-chart roll is arranged so that the temperature and the weight of the feed water are recorded



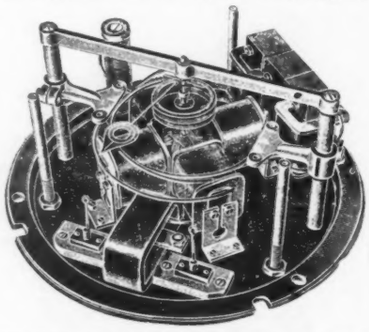
TEMPERATURE AND WEIGHT OF FEED-WATER RECORDED ON SAME CHART

on the same sheet, and both of these values can be obtained for any time during the twenty-four hours. This chart is also convenient for filing, and a large book is furnished with the meter for permanent records. The outfit is furnished complete with a 5-in (12.7-cm.) sensitive bulb, a separable 0.75-cm. (1.9-cm.) connection and 10 ft (3 m.) of flexible insulated tubing. The instrument heretofore went under the name of the Lea V-notch meter, but it is now known as the Yarway V-notch meter with Lea recorder.

Rotary Synchronizers

Brushes for leading current to and from the moving coil are dispensed with and frictional effects are overcome in a rotary synchronizer that has been placed upon the market by Nalder Bros. & Thompson, Ltd., London, Eng. This is accomplished by the use of a small transformer in the instrument which is provided with a circular secondary coil. The secondary coil is electrically connected to the moving coil of the instrument and is rigidly attached to the spindle so that it is free to revolve in a narrow air gap without touching either the primary coil or the iron core of the transformer.

Surrounding the moving coil are four fixed coils. Two of these are connected in series with a resistance wound on a porcelain bobbin, and the other two are connected in series with a choking coil

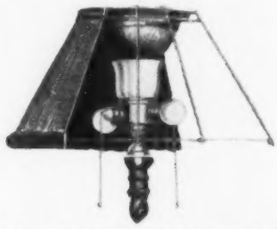


INTERIOR WITH TRANSFORMER PRIMARY COIL AND CORE REMOVED

which is shown to the right behind the fixed coil. These two circuits are connected in parallel across the terminals of the incoming alternator. A magnetic field rotating with a frequency equal to that of the incoming alternator is thus produced. Similarly, the primary coil of the instrument transformer is connected to the busbar terminals of the meter, the moving coil thus receiving current of busbar frequency and setting up a pulsating magnetic field. The interaction between this and the rotating field causes the pointer to revolve in one direction or the other according to whether the frequency of the incoming alternator is greater or less than the busbar frequency. The number of revolutions per second made by the pointer is equal to the difference of these two frequencies. When the incoming alternator is running at synchronous speed the pointer comes to rest, but its position on the dial then gives a direct indication of the phase displacement between the busbar electromotive force and that of the incoming alternator. By slightly adjusting the speed of the latter the pointer can be caused to move slowly around until it coincides with the bold mark at the top of the dial. Assuming the voltage of the incoming alternator and the busbars to be equal, the synchronizing switch may be closed and the excitation of the alternator adjusted until it takes its due share of the load.

Adapter for Portable Lamps

An adapter for portable lamps that permits the use of a great variety of lamp shades has recently been brought out by the National X-Ray Reflector



LAMP ADAPTER SMALL AT TOP

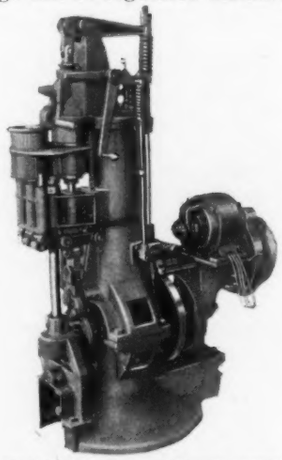
Company of Chicago. This adapter is listed as the "Curtis" and contains the X-ray mirror reflector which fills the room with a mellow, glareless light.

Semi-Indirect Lighting Fixture

A semi-indirect lighting fixture that is designed for use with a gas-filled lamp is being marketed by the Daylite Fixture Company, 416 South Dearborn Street, Chicago. This fixture is known as the Bel-Ko-Lite. The manufacturers claim that it can be easily cleaned and gives perfect diffusion.

Piston Vacuum Machine

The piston vacuum machine used by canners and preservers shown in the accompanying illustration combines a tumbler-sealing machine and a vacuum pump in one single unit. The amount of vacuum desired in each package can be regulated instantly and



SEALING AND VACUUM PUMP

the receptacle sealed immediately. The machine is made by the Anchor Cap & Closure Company, Brooklyn, N. Y., and is operated by a Westinghouse 0.75-hp. motor.

Trade Notes

SCHNEIDER ET CIE removed their offices on April 25 to 21 East Fortieth Street, New York City.

SUSSMAN & SUSSMAN, electricians, have removed their factory and offices to 8 and 10 East Thirty-first Street, New York City.

THE H. W. JOHNS-MANVILLE COMPANY of New York City will have its office at Houston, Tex., at 424-426 Washington Avenue after July 1.

THE WAR TRADE BOARD of Washington, D. C., has issued supplement No. 1, a revision of the "Enemy Trading List," containing additions, revisions, removals and corrections to April 1.

THE ELECTRIC SERVICE SUPPLIES COMPANY has secured larger quarters in the Hudson Terminal Building, 50 Church Street, New York City, and is now occupying rooms 1771 and 1773.

McCARTHY BROTHERS & FORD of Olean, N. Y., manufacturers of electrical power, lighting and heating supplies, have moved into their new five-story concrete building at 75 to 79 West Mohawk Street.

H. O. BOURKARD will succeed F. Ernest Lauderbach as representative of the National X-Ray Reflector Company in its Southern territory. The company's St. Louis office has been closed, and Mr. Bourkard will make his headquarters at some central point in the territory.

THE ELECTRICAL SUPPLY & REPAIR COMPANY of Hazard, Ky., is reported as a new enterprise. L. B. Trumbull is president, and associated with him are C. E. Carlin and R. L. Cornell. The latter was formerly general manager of the Kentucky River Power Company.

JOHN A. DIENNER has been made a member of the firm of Brown, Hanson & Boettcher, 1550 Monadnock Block, Chicago. Mr. Dienner has been associated with this firm of patent attorneys for four years, prior to which time he was an assistant examiner in the United States Patent Office at Washington, D. C.

THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE, Department of Commerce, Washington, D. C., has published "Foreign Tariff Notes No. 27," reprinted from "Commerce Reports October-December, 1917." Copies may be obtained by forwarding 10 cents to the superintendent of documents, Washington.

F. T. BANGS, formerly of the advertising and sales department of the George Cutter Company of South Bend, Ind., has been made advertising manager of the Belden Manufacturing Company of Chicago. Prior to his connection with the George Cutter Company Mr. Bangs was for one and a half years associate editor of the *Electrical Review*.

THE MERCURY MANUFACTURING COMPANY of Chicago is issuing a sixteen-page monthly newspaper entitled *The Trackless Train*, illustrated, and devoted to the description and exploitation of its "Mercury tractors." In other words, the tractor is aimed to meet the need for better and more modern trucking methods adaptable to factory purposes.

CHESTER H. PENNOYER on April 7 became general sales manager of the National Conduit & Cable Company of New York City. He will devote much of his time to traveling in the Eastern States. Mr. Pennoyer is from Oakland, Cal., where he was physical superintendent of the Great Western Power Company during the construction of the big hydroelectric plant.

THE LIBERTY MANUFACTURING COMPANY, just formed, has acquired a plant at Carrollton Avenue and Oleander Street, New Orleans, La., it is reported, to manufacture electrical, foundry and other products. Eph. Rosenberg is president, P. Sefton Schneidau vice-president, and B. B. Hans secretary-treasurer. Operation of the plant has begun. The property measures 318 ft. by 310 ft. and is a "daylight" plant, equipped along modern lines.

THE DEPARTMENT OF COMMERCE of Washington, D. C., has issued, through the Bureau of Foreign and Domestic Commerce, a report entitled "German Trade and the War." It is the work of Chauncey D. Snow, assistant chief of the bureau, in collaboration with J. J. Kraal. The part that Germany is planning to play in after-the-war trade is described thoroughly and authoritatively. A copy may be had by addressing the bureau or its co-operative offices.

E. E. MAHER has been appointed by the Terry Steam Turbine Company of Hartford, Conn., manager for the Chicago district, with offices at 1328-29 McCormick Building, 322 South Michigan Avenue. John D. Stout has become manager of the New York office of the Terry company in charge of that district, with the exception of navy and marine installations. Mr. Stout has been assisting Mr. Herbert, formerly in complete charge of the New York district, who will now devote his entire time to navy and marine requirements.

Trade Publications

OIL.—Turbo machine oil is advertised in a circular being distributed by the Borne Scrymser Company, 80 South Street, New York.

WIRE-HOLDERS.—Hubbard & Company, Pittsburgh, Pa., is distributing a circular describing the Peirce wire-holder for open wiring.

ELECTRIC FORGES. — The Buffalo Forge Company of Buffalo, N. Y., is distributing an illustrated catalog describing its portable forges.

ELECTRIC FANS.—A dealer circular has been issued by the Carleton Company, 170 Summer Street, Boston, Mass., describing the "Liberty" fan.

BULLETIN INDEX.—The General Electric Company, Schenectady, N. Y., has issued indexes to descriptive bulletins and sheets and also index of supply part bulletins.

FLOOR SWEEPERS.—William Firth, 200 Devonshire Street, Boston, has issued a folder describing the Firth broomless floor sweeper for cotton mills. This device sweeps floors by air suction.

SOCKETS.—"Harmony in Fixtures" is the title of a two-page circular being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, describing its porcelain sockets.

MAZDA LAMPS.—The new Westinghouse Mazda carton in orange and black is illustrated in a folder being distributed by the Westinghouse Lamp Company, 165 Broadway, New York City.

STEAM TRAPS.—The Sterling direct-return steam trap is described and illustrated in a circular issued by the Templeton Manufacturing Company, Parkway and Sterling Streets, Cambridge, Mass.

HIGH-TENSION INDOOR EQUIPMENT. —Switches, fuses and choke coils are illustrated and described in bulletin No. 33, being issued by the Delta Star Electric Company, 2433 Fulton Street, Chicago.

FIRE ALARM SYSTEMS.—W. R. Ostrander & Company, 371 Broadway, New York City, have issued a bulletin describing their fire-alarm system for factories, hotels, department stores and public institutions.

STORAGE BATTERIES.—The General Lead Batteries Company, Chapel Street and Lister Avenue, Newark, N. J., is distributing bulletins Nos. 25, 26 and 27, describing its storage batteries for starting and lighting automobiles.

ELECTRICAL SPECIALTIES.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued a catalog on electrical specialties, containing illustrations of the newest Hubbell specialties, with charts, indexes, price lists, etc., for the same.

ELECTRICAL SPECIALTIES. — The Hamilton-Beach Manufacturing Company, Racine, Wis., has issued a booklet for its salesmen entitled "Electric Labor-Saving Devices." It shows not only the company's product but also its sales helps.

BALL BEARINGS.—The SKF Ball Bearing Company, Hartford, Conn., has issued an illustrated booklet entitled "Woodworking Precision at High Speed." The bulletin deals with the application of ball bearings to electric motors for woodworking.

SILENT CHAINS.—Book No. 312 has been issued by the Link-Belt Company, Philadelphia, describing the Link-Belt silent chain drive for operating machine tools. The bulletin is profusely illustrated with machines showing actual installations.

RHEOSTATS. — The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a circular entitled "Universal Charging Rheostat for Charging of Starting, Lighting and Ignition Batteries." This device can be used to charge any number of cells from one to the maximum that can be connected in series and charged from 40 volts.

New Incorporations

THE KENNEDY-WEBSTER ELECTRIC COMPANY of Chicago, Ill., has been incorporated with a capital stock of $30,000 by Harry M. Kennedy, William H. Webster and Kenneth G. Kennie.

THE GENERAL SUPPLY & LIGHT COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by J. B. Goldenberg, H. A. Rocker, J. Schnuerer and Arthur Krause.

THE CONTINENTAL ELECTRIC COMPANY of Detroit, Mich., has been chartered with a capital stock of $10,000. The incorporators are: M. R. Bryant, Henry Burdeno, W. J. Moore of Detroit.

THE WHOLESALE ELECTRICAL SUPPLY COMPANY of Tulsa, Okla., has been incorporated with a capital stock of $30,000 to deal in electrical supplies. Albert H. Bell is president and Ray S. Fellows secretary.

THE STORAGE BATTERY & APPLIANCE COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $150,000. The incorporators are: Donald G. Scott, William Knoblock and William J. Graham.

THE BELYEA-GRANT ELECTRIC MACHINERY COMPANY of New York, N. Y., has been incorporated by R. Grant, B. M. and T. S. Belyea, 48 East Eighth Street, New York City. The company is capitalized at $5,000.

THE UNITED ELECTRIC COMPANY of Marlboro, Mass., has filed articles of incorporation with a capital stock of $10,000. The directors are: H. J. Rougeau, president; Arthur J. Rougeau of Marlboro, treasurer, and E. M. Rougeau.

THE HARRY S. ORR COMPANY of Boston, Mass., has been incorporated by Harry S. Orr, George M. Heathcote of Newton and George L. Ellsworth of Boston, Mass. The company is capitalized at $50,000 and proposes to deal in electrical goods.

THE ELECTRIC TYPE DAIRY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The incorporators are: M. I. Porty, F. D. Buck and K. E. Longfield of Wilmington, Del.

THE OHIO MECHANICAL & ELECTRICAL MAINTENANCE COMPANY of Mansfield, Ohio, has been incorporated with a capital stock of $1,000 by William H. Thompson, Guy E. Thompson, Ellsworth G. Clark, Harry Calhoun and Frank Schwartz.

THE R. V. G. COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $25,000 to manufacture electrical specialties. The incorporators are: F. Goldberg, R. Goldberg, Great Kills, S. I., and L. J. Cohen, 52 Broadway, New York City.

THE BANNISTER HYDROELECTRIC COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of $200,000 by George R. and Robert B. Bannister and Perry H. Brown. The company proposes to manufacture an electric gage and similar products.

THE PHILADELPHIA ELECTRIC STEEL COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $70,000 to do a general steel business. The incorporators are: C. L. Rimlinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE DILWORTH MANUFACTURING COMPANY of Hoboken, N. J., has been incorporated by Ernest E. Davies of Hoboken; N. P. Hill of Montclair, and George C. Sprague of Englewood Heights, N. J. The company is capitalized at $50,000 and proposes to manufacture wireless and electrical equipment.

THE JOHN C. SERVICE COMPANY of New York, N. Y., has been incorporated by J. C. Williams, Lake View Avenue, Brightwaters; A. Stemmermann, 417 Brevoort, Richmond Hill, and W. S. Ross, 64 Montague Street, Brooklyn. The company is capitalized at $25,000 and proposes to do a general contracting and electrical engineering business, etc.

THE SINGLAND POWER COMPANY OF NEW JERSEY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $250,000 and proposes to acquire patent rights to develop power by air. The incorporators are: Leonard Singland, Frank P. Venable, John H. Mussiner and Louis J. Patmost of Paterson, N. J.

New England States

CONTOCOOK, N. H.—The Contocook Electric Light Company is extending its electric transmission line through the town south of Willow Hollow to connect with the Boston and Maine lines.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has completed its dam on the Piscataquog River at Gregg's Falls. Two generators of 1500 kw. each will be installed in the new power station. Electricity will be transmitted at 33,000 volts to the Kelley's Falls station. The main generating room of the power station, not yet completed, will be 85 ft. by 40 ft.; the transformer room will be 25 ft. by 74 ft., and will be equipped with three transformers each having a rating of 1250 kva.

LUDLOW, VT.—Arrangements have been made by the commissioners of the municipal electric light plant with the Colonial Power & Light Company of Cavendish for furnishing 200 kw. additional, which is to be used by woolen mills working on government orders.

CANTON, MASS.—Plans have been prepared by A. H. Wright, 53 State Street, Boston, for the construction of an addition to the engine house of the plant of the Springdale Finishing Company.

MILLBURY, MASS.—The New England Power Company of Worcester has petitioned the Selectmen for permission to erect a high-tension transmission line across the Providence Railroad and South Main Street, near the Sutton line. The proposed line will extend from Worcester to Webster.

SPRINGFIELD, MASS.—The United Electric Light Company will remodel its building at State and Water Streets for an electrical switching station. The cost is estimated at $102,000. Contract, it is understood, has been awarded for the work.

DANBURY, CONN.—The property of the National Electric Utilities Corporation of Danbury has been purchased by Landers, Frary & Clark of New Britain. The purchasing company, it is understood, will continue the business of the Utilities corporation in its present building and plan extensions to same.

NORWICH, CONN.—Contract has been awarded by the Eastern Connecticut Power Company to Fred T. Ley & Company, Springfield, Mass., for the construction of its proposed steam power station in Norwich.

PUTNAM, CONN.—Plans have been prepared by the Cochrane Manufacturing Company, 56 Barrett Avenue, Malden, Mass., for the construction of a new power house, transmission system, and dam in Putnam. Erastus Worthingham, of Dedham, Mass., is engineer.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by the Board of Contract and Supply, Albany, until June 17 for electric-lighting fixtures for the city hall. Drawings and specifications, etc., may be seen at the office of the associate architects, C. G. Ogden and Joseph J. Gander, 61 State Street, Albany, or at the office of the Board of Contract and Supply, City Hall.

ALBION, N. Y.—The contract for the construction of the proposed addition to the boiler plant at the Western House of Refuge has been awarded to Henry C. Belson of Albion.

BINGHAMTON, N. Y.—The Ansco Company has awarded a contract to the Binghamton Light, Heat & Power Company for furnishing electricity to operate its plant at Johnson City. About 100 hp. will be required in small motors.

BROOKLYN, N. Y.—Plans have been filed and contract awarded to John H. Deeves & Brother, 103 Park Avenue, New York City, by the Arabol Manufacturing Company, 100 William Street, New York, for the erection of an addition to the boiler plant at its local works.

BROOKLYN, N. Y.—Contracts have been awarded by the E. W. Bliss Company of Brooklyn to the Hedden Construction Company, 52 Vanderbilt Avenue, New York City, and W. H. and F. W. Cane, Woolworth Building, for the construction of an addition (seven stories) to its projectile works on Fifty-third Street, near First Avenue, 200 ft. by 300 ft., to be supplemented by a pier, 60 ft. by 575 ft.

BUFFALO, N. Y.—Plans are being prepared for the construction of a new power house, about 40 ft. by 40 ft., in connection with the new plant of the Buffalo Cereal Company.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CENTRAL ISLIP, N. Y.—Plans are being considered by the State Hospital Commission for the installation of new boilers and other equipment at the State Hospital at Central Islip. The installation of a new heating plant at the institution is also contemplated. E. S. Elwood is secretary of the commission.

GLENS FALLS, N. Y.—The construction of a new transformer station at Canastota is under consideration by the Adirondack Electric Power Corporation. H. J. Hunsicker is chief engineer.

NEW YORK, N. Y.—Plans have been prepared for the construction of a new transformer station for the Gryphon Rubber & Tire Company on Bailey Avenue near 192d Street.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, New York, has purchased a site, 47 ft. by 100 ft., on which it proposes to erect an electric power station.

NEW YORK, N. Y.—Work has begun on the erection of a new power house to be built by Kenneth Stevenson, 25 Broad Street, at 172-80 Water Street. The proposed building will be 105 ft. by 115 ft., five stories, and will cost about $350,000.

OLEAN, N. Y.—The Olean Electric Light & Power Company is contemplating the purchase of additional equipment.

CAPE MAY COURTHOUSE, N. J.—The contract for installing electric lighting fixtures for the Middle Township high school at Cape May Courthouse has been awarded to the L. L. Jones Company, 1019 Atlantic Avenue, Atlantic City.

SOUTH PLAINFIELD, N. J.—Plans are being considered by the Spicer Manufacturing Company for the construction of a new power house at its works here.

TRENTON, N. J.—Preliminary plans are being prepared by J. O. Hunt, 114 Montgomery Street, architect, for the construction of a new power plant at the works of John E. Thropp & Sons, Lewis Street.

TRENTON, N. J.—The City Commission has granted the Trenton & Mercer County Traction Corporation permission to erect wires on the poles on South Broad Street between Liberty Street and Cedar Lane, owned by the Public Service Corporation and the Bell Telephone Company. The company is making improvements to its street car line in the West State Street section, as well as on the Princeton, Lawrenceville, Pennington, Hopewell and Yardville divisions.

BETHLEHEM, PA.—The Bethlehem Electric Company has filed notice with the Public Service Commission of an issue of $50,000 in bonds, the proceeds to be used for extensions and improvements.

ELWOOD CITY, PA.—The Pennsylvania Power Company, which recently purchased considerable water-front property in the Turkey Hill section, about 5 miles south of Wrightsville, is reported to be planning the construction of a dam.

ERIE, PA.—The Burke Electric Company is reported to be planning an addition to its local plant. Another small plant, it is said, will be established in Conneautville in the near future by the company for the manufacture of a new line of electrical work.

HARRISBURG, PA.—The Harrisburg Light & Power Company has filed notice with the Public Service Commission of an issue of $50,000 in bonds, the proceeds to be used for extensions and improvements.

LANCASTER, PA.—The Edison Electric Company has filed notice with the Public Service Commission of an issue of $115,000 in bonds, the proceeds to be used for extensions and improvements to its system.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 20 under specification 2952 for construction of power house and two transformer stations at Philadelphia, to cost about $188,000.

PITTSBURGH, PA.—Plans are being prepared for the construction of a new power plant for the Pittsburgh Modern Laundry Company in connection with its proposed new plant. The cost of the entire work is estimated at about $60,000. Paul W. Irwin, Renshaw Building, Pittsburgh, is architect.

WESCOESVILLE, PA.—The construction of an addition to the local boiler plant is under consideration by the Commissioners of Lehigh County for which plans are now being prepared by Tilghman Moyer, architect, 824 Hamilton Street, Allentown.

LINTHICUM HEIGHTS, MD.—Work has begun on the erection of the proposed new power house of the Consolidated Gas & Electric Company in Linthicum Heights, to cost about $7,000. The Cogswell-Roether Company, 406 Park Avenue, Baltimore, has contract for building.

ST. HELENA, MD.—Contract has been awarded by the United States Shipping Board to the Consolidated Engineering Company, Calvert Building, Baltimore, for construction of bakery, power house, 302 convertible houses, etc., at St. Helena, to cost about $800,000.

ALEXANDRIA, VA.—Contracts have been awarded by the Virginia Shipbuilding Corporation of Alexandria for the construction of a shipbuilding plant on the Potomac River, to cost about $5,000,000, to Frederick T. Ley & Company, 19 West Forty-fourth Street, New York, N. Y., and the Raymond Concrete Pile Company, 90 West Street, New York. The initial works will consist of 12 one and two-story buildings, including a machine shop and a foundry.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, until May 20, for installing at the navy yard, Philadelphia, Pa., coal and ash-handling equipment for aircraft factory, to cost approximately $35,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 27 for constructing an eight-way tile duct system with manholes, complete for break-down service between the frequency changer building, Navy Yard, and the Capitol power plant, Garfield Park, Washington. Drawings and specification No. 2959 may be obtained upon application to the above bureau or to the commandant of the navy yard named.

North Central States

BELLAIRE, MICH.—At an election held recently the proposal to issue $6,000 in bonds for improvements to the municipal electric-light plant was carried.

AKRON, OHIO.—A permit has been granted the Wellman-Seaver-Morgan Company for the erection of a fireproof power house on Kenmore Boulevard.

CALEDONIA, OHIO.—The County Commissioners have granted the Delaware & Marion Railway Company a franchise to erect transmission lines from Marion to Caledonia, a distance of 10 miles, to furnish electricity here. The local electric plant was recently closed down on account of the high cost of fuel and labor.

CINCINNATI, OHIO.—The Union Gas & Electric Company is reported to be contemplating the installation of a third electric generating unit.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until May 24, for steel smoke breeching for the division of light and heat.

CLEVELAND, OHIO.—The France Manufacturing Company, 1434 West Seventy-fifth Street, is planning to build a new plant at Berea Road. The company manufactures magnetic rectifiers, ammeters, electric meters, carbon rheostats and rotary strippers.

DILLES BOTTOM, OHIO.—The power plant of the Fort Pitt coal mines in Dilles Bottom was destroyed by fire recently, causing a loss of about $25,000.

EATON, OHIO.—The County Commissioners have granted the Twin Valley Light & Power Company a franchise to erect and maintain electric transmission lines to transmit electricity for a distance of about 9 miles, in the southeast part of Preble County for a period of 25 years. The company proposes to supply electricity to farmhouses along the line, which it will purchase from a traction company. J. E. Flora, William Knopp and others are interested.

HAMILTON, OHIO.—Bids will be received at the office of the County Commissioners, Hamilton, Ohio, until May 25 for the installation of a lighting system for bridge and viaduct over the Miami River between Middletown and West Middletown, including furnishing and placing of conduits, glassware, metal globe holders, sockets, etc. Plans and specifications

are on file in the office of the county auditor and County Commission, Hamilton.

HURON, OHIO.—The City Council is considering an issue of $4,500 in bonds for improvements to the municipal electric-light plant and water-works system, including the installation of two electric motor-driven water pumps, equipping the water department with meters and providing equipment for unloading coal at the railroad station.

MANSFIELD, OHIO.—Preparations are being made by the Farmers' Dairy & Produce Company for enlarging and remodeling its plant on East Third Street. It is proposed to equip the plant to purify the milk by the electrical process. The name of the company has been changed to the Electro Pure Process Company.

SANDUSKY, OHIO.—Preparations are being made by the Hinde & Dauck Paper Company to move into its new factory. The power requirements of the new plant will be considerably in excess of the old factory. All direct-current motors will be eliminated. Power for operating the plant will be supplied by the Sandusky Gas & Electric Company.

TOLEDO, OHIO.—The City Council has authorized the installation of 50 additional arc lamps in the streets of the city.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company has applied to the Public Utilities Commission for permission to issue $600,000 in bonds to be sold at 90, and $200,000 in preferred stock. The Interstate Commerce Commission has approved an application by the company to issue these securities.

LEXINGTON, KY.—The American Metallic Packing Company, it is reported, would like to receive prices on a 300-kw., 250-volt, second-hand (must be in first-class condition), direct-current generator directly connected to steam engine.

DANVILLE, IND.—The Merchants' Heat & Light Company of Indianapolis has applied to the Public Service Commission for permission to issue $140,000 in bonds and $60,000 in capital stock, the proceeds to be used to purchase the property of the Danville Light, Heat & Power Company. The local company purchases energy from the Merchants' company and distributes it in Danville, Plainfield, Brownsburg, Clermont, Avon and rural districts adjacent.

CHICAGO, ILL.—Contracts, it is reported, have been awarded by the Illinois Central Railroad Company for the construction of a new electric power plant at Ninety-eighth Street and Cottage Grove Avenue to Joseph E. Nelson & Sons, 118 LaSalle Street, Chicago. The cost of the proposed plant is estimated at about $60,000.

CLINTON, ILL.—Preparations are being made by the Illinois Central Railroad Company, it is reported, for improvements to its local shops. The proposed work will include rebuilding the machine shop, enlarging the erecting shop, the construction of a new power house, installation of new boilers and other work, for which contracts, it is understood, have been awarded.

NORTH CHICAGO, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 27 under specification 2993 for installing an electric distributing system at the Great Lakes Training Station. Further information may be obtained on application to the chief of bureau.

ST. JOSEPH, ILL.—Plans have been prepared for rebuilding the plant of the Berry Iron & Steel Company, which was recently destroyed by fire. It is proposed to replace the two buildings burned with five, designed for railroad foundry work. The main foundry room will be 50 ft. by 260 ft., and will be equipped with two cranes.

PRESTON, MINN.—The Root River Power & Light Company, it is reported, is planning to extend its electric system from Caledonia to Houston during the coming summer.

DES MOINES, IOWA.—All bids submitted for the electroliers (259) for lighting the Capitol extension have been rejected. The lowest bid was $80,000, which was considered too high by the Council. It has been decided to postpone indefinitely the installation of ornamental lamps and to reduce the number of lamps to be installed at this time to a number sufficient to make the grounds safe.

NEW ENGLAND, N. D.—The Asby Light & Power Company is reported to have purchased the property and equipment of the Gardner Electric plant. As soon as the necessary changes in connection with the consolidation can be made, a 24-hour service will be established.

BRADLEY, S. D.—The Dakota Northern Power Company, it is reported, is contemplating the construction of a power station and the purchase of equipment. E. L. Lewis is secretary.

ATWOOD, KAN.—The municipal electric-light plant has recently been changed over from direct to alternating current. New electric lines are being erected in the city limits. The plant is driven by Fairbanks-Morse oil engines. S. F. Snyder is superintendent.

Southern States

GLIDEN, N. C.—R. O. Blanchard, of Glíden, it was reported, would like to communicate with manufacturers and dealers of electrical and water-power machinery.

ATLANTA, GA.—Contract has been awarded to the Bailey Oliver Electric Company, 73 Walton Street, Atlanta, for furnishing addition to main switchboard, power tablet and electric feeders for lamps and motors in the United States penitentiary at Atlanta, at $3,300.

COLUMBIA, TENN. — Arrangements have been completed by the Southern Cities Power Company for the construction of a power plant on Duck River, to cost about $100,000. The work will include the construction of a crib dam, 12 ft. high, a power house and a 15-mile transmission line to Mount Pleasant, at a cost of $25,000. The initial installation will provide for a development of 450 hp. for transmission to Mount Pleasant. Contracts have been placed for equipment and construction work.. M. R. Stern is general manager.

RUTHERFORD, TENN.—At an election held recently bonds to the amount of $10,000 were voted for the installation of an electric-light plant in Rutherford.

DE QUEEN, ARK.—The De Queen Lumber Company is planning to equip its mill, having a daily capacity of 100,000 ft., with motor-driven machinery. W. O. Creason is manager.

GUEYDAN, LA.—The city has taken over the electric-light plant and water-works system, to be owned and operated by the municipality. Improvements involving an expenditure of $15,000 will be made to the electric plant, and $20,000 will be expended on the water works. An ice factory of 10 tons capacity will be built at a cost of about $10,000. It is proposed to house the three plants in one building. New equipment, including crude-oil engine, to develop from 50 to 100 hp., will be installed in the electric plant; plans for the water works include a 6-in. deep well, 60,000-gal. tank, 100-ft. elevation, pumps, mains, etc. The J. B. McCrary Company of Atlanta, Ga., has charge of the engineering work.

JENNINGS, OKLA.—Bonds to the amount of $25,000 have been voted for the installation of an electric-light plant in Jennings.

OKLAHOMA CITY, OKLA.—Final plans have been prepared for the construction of the Chickasaw hosiery mills, which will include a 150-hp. steam and electric power plant and dyeing machinery. The plant will be equipped with electric-driven motor machinery. The cost of the entire plant is estimated at about $60,000. T. E. Cullen, Colcord Building, is secretary and treasurer.

DEL RIO, TEX.—Steps have been taken by the City Council for the installation of a municipal electric-lighting plant.

MERCEDES, TEX. — The Mercedes Water, Light & Power Company is planning to install a new 100-hp. engine and generator. When improvements are completed a 24-hour service will be established in Mercedes.

RUSK, TEX.—Improvements are contemplated by the Texas Steel Company involving an expenditure of about $75,000, and will include the installation of a large pump, for water circulating, improvements to blast furnace and pipe foundry, replacing motors and overhauling cranes, etc. Work is already under way.

Pacific and Mountain States

SEATTLE, WASH.—The Board of Public Works has selected the Skagit River power site for immediate development for additional power for the city. All other offers have been rejected. The board has suggested to the Council that new detailed plans and specifications be prepared in accordance with the physical condition encountered on the Skagit River, conditional upon the approval of the site by the City Council.

SPOKANE, WASH.—The Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., it is reported, has acquired the controlling interest in the Spokane Heat, Light & Power Company, which operates a central heating, lighting and power plant, furnishing service to the central district of Spokane.

TACOMA, WASH.—The City Lighting Department is considering a contract with the Tacoma Railway & Power Company, under which the company will install, maintain and operate the large generator which the city has purchased and for which no space has been provided. The Tacoma company has offered for $1,800 per year to install and operate the generator and hook it up with its own switchboard, so that if the peak load were exceeded the company could cut in the city line on its own current. Hamilton Gronen, commissioner of light, estimates that it would cost the city $10,000 to build a substation on the tideflats and $4,500 for salaries to operate the plant.

ASTORIA, ORE. — The Hammond Lumber Company, it is reported, has placed contracts for an additional turbine and generator of 2000 hp. and for four 600-hp. water-tube boilers.

PORTLAND, ORE.—The contract for the electrical equipment in the new municipal grain elevator in Portland has been awarded to the Ne Page-McKinney Company of this city.

PORTLAND, ORE.—The Liberty Foundry, Inc., recently incorporated, has leased the plant of the Lister Sash Weight Company, which it proposes to equip for a foundry and machine shop. The company contemplates adding electric welding and brass and bronze casting departments. William Cornfoot, shipbuilder, is among the incorporators.

GRIDLEY, CAL.—Contracts, it is reported, have been placed by Rosenburg Brothers & Company of Gridley for equipment for an entire new power plant to operate their rice mill here. The capacity of the new plant will be 40 per cent more than the present plant. Arrangements are also being made by the company to build a new two-story mill, 100 ft. by 240 ft., to be equipped with all new labor-saving devices. The company is reported to be planning the erection of two additional mills in the Sacramento Valley at points yet to be designated.

HOLLISTER, CAL.—The installation of an electrolier lighting system in the business district of the town is under consideration.

MODESTO, CAL.—Plans are being considered by the Sierra & San Francisco Power Company for extensive improvements, including the construction of a hydroelectric power plant on the Middle Fork of the Stanislaus River.

SAN FRANCISCO, CAL.—Plans of the Bethlehem Steel Company for the construction of a large steel ship repair plant at Hunter's Point, San Francisco, have been accepted by the United States government. The work includes the erection of machine shops, fabricating plants, marine railroad and other equipment. Three floating docks, with a capacity of 8000, 4000 and 3800 tons, respectively, are to be moved to the new location, and two additional docks built. The cost of the entire project is estimated at $2,000,000.

NOGALES, ARIZ.—The Arizona Gas & Electric Company of Nogales has petitioned the State Corporation Commission for permission to issue $100,000 in bonds, the proceeds to be used to pay for outstanding indebtedness and for an additional generating unit, to cost $30,000.

CALIENTE, NEV.—The installation of an electric-lighting system in Caliente is reported to be under consideration.

Canada

VANCOUVER, B. C.—The Jarvis Electric Company of Vancouver has been awarded the contract for electrical machinery to be installed on the three auxiliary sailing ships under construction by the William Lyall Shipbuilding Company, including three generators, directly connected to gasoline engines, electrically driven sail hoists and motor equipment for air-compressors and bilge pumps.

BROCKVILLE, ONT.—Arrangements are being made by the Cedar Rapids Transmission Company to supply electricity generated at Mille Roches to the towns along the St. Lawrence River. Brockville, it is understood, will be the chief distributing center.

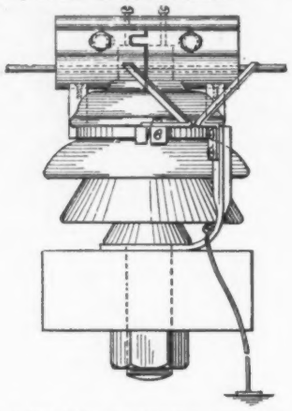
HAMILTON, ONT.—The installation of a private power plant in the City Hospital is under consideration by the board of governors. Dr. W. A. Langrill is medical superintendent.

(Issued April 30, 1918.)

1,263,497. Apparatus for Regulating Heating Systems; Everett H. White, St. Paul, Minn. App. filed Feb. 17, 1915. Dampers of a heating furnace, hot water, steam or otherwise, may be suitably controlled.

1,264,137. Measured-Service Telephone System; Albert Andersen, Chicago, Ill. App. filed Dec. 5, 1913. Improvements.

1,264,158. Telephone System; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 2, 1917. Improvements.



1,264,396—Lightning Arrester

1,264,174. Knife and Wax Heater; Frederick M. Furber, Revere, Mass. App. filed Nov. 4, 1914. For manufacture of shoes.

1,264,176. Telephone-Call Recorder; Rupert H. Greenlaw, Lawrence, Mass. App. filed April 15, 1916. May be readily attached to a portable telephone instrument.

1,264,183. Measured-Service Telephone System; Harry E. Hershey, White Water, Kan. App. filed Nov. 28, 1913. Improvements.

1,264,204. Apparatus for Transmitting and Displaying Signals and the Like; Archibald R. Mitchell, London, England. App. filed March 23, 1915. For displaying announcements in hotels.

1,264,255. Electrical Socket Fitting; William F. Anklam, Detroit, Mich. App. filed April 18, 1917. For connecting the incandescent lamps of a vehicle lighting system.

1,264,270. Electrode - Shielding Device; David F. Carpenter, Wilkinsburg, Pa. App. filed July 6, 1915. Improvements.

1,264,272. Electrical Winding; Lewis W. Churb, Pittsburgh, Pa. App. filed July 12, 1917. Energy of a structurally discontinuous winding may be uniformly distributed throughout.

1,264,276. Vapor - Arc Rectifier; Frank Conrad, Swissvale, Pa. App. filed May 11, 1914. Relates to metallic containing receptacles for vapor-arc rectifiers.

1,264,280. Arc Lamp; William A. Darrah, Wilkinsburg, Pa. App. filed Jan. 24, 1914. Provision made for withdrawing the fumes and vapors from the arc chamber.

1,264,297. System of Control; Arthur J. Hall, Wilkinsburg, Pa. App. filed Feb. 10, 1916. Regenerative control of electric railway motors.

1,264,298. System of Distribution and Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 19, 1914. Control of polyphase induction motors.

1,264,299. System of Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 10, 1914. Improvements.

1,264,300. Street-Traffic-Signal Apparatus; Harry D. Heuer, St. Louis, Mo. App. filed May 23, 1914. Improvements.

1,264,326. Electric Welding Apparatus; John P. Nikonow, Dayton, Ohio. App. filed Sept. 7, 1917. Manually controlled electric arc.

1,264,333. Circuit Interrupter; Carl C. Randall, Edgewood Park, Pa. App. filed Aug. 2, 1913. Knife-blade switch of the quick-break type.

1,264,335. Control System; Lynn G. Riley, Wilkinsburg, Pa. App. filed May 3, 1915. For controlling dynamo-electric machines.

1,264,340. Reversing Mechanism for Washing Machines; George Simon and Fritz Balzer, Chicago, Ill. App. filed Feb. 8, 1915. Actuated by the movement of the reversible parts.

Record of Electrical Patents

Notes on United States Patents

1,264,354. Control System; Charles C. Whitaker, Wilkinsburg, Pa. App. filed Aug. 10, 1915. For pantograph trolleys.

1,264,366. Calling Device; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 13, 1916. Impulse transmitters for automatic and semi-automatic telephone systems.

1,264,378. Controlling System; Amos F. Dixon, Newark, N. J. App. filed March 16, 1914. Arranged to control the feed of a paper tape such as is used in automatic telegraphy.

1,264,388. Telephone System; Olof M. Guthe, East Orange, N. J. App. filed Aug. 20, 1917. Improvements.

1,264,396. Lightning Arrester; Frederick W. Hays, Pittsburgh, Pa. App. filed June 15, 1916. Improvements.

1,264,402. Metering System for Automatic Telephone Exchanges; Jacob W. Lattig, Glenside, Pa., and Charles L. Goodrum, New York, N. Y. App. filed Sept. 24, 1915. Subscribers are charged for calls as originated in accordance with the services rendered.

1,264,404. Knife-Blade Switch; Ronald Lister, Chorlton-cum-Hardy, England. App. filed June 27, 1917. Hinge and contact members formed entirely of strip metal.

1,264,405. Arc-Lamp Globe; George M. Little, Pittsburgh, Pa. App. filed Aug. 11, 1913. Arc lamps.

1,264,406. Post-Type Arc Lamp; George M. Little, Pittsburgh, Pa. App. filed Dec. 4, 1913. Permits inspection of lamps and the necessary replacements to be readily made, and will allow of a weatherproof design.

1,264,413. Signal Device; Jesse F. MacDonald, Billings, Mont. App. filed April 30, 1917. Adapted for use on motor vehicles.

1,264,414. Disconnecting Switch; Joseph H. Mahoney, Wilkinsburg, Pa. App. filed April 24, 1913. Will open and close with a minimum pull or twist on the insulators forming the pillars of the switch.

1,264,415. Electrical Protective Device; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed April 3, 1914. For reverse-current and underload tripping devices for circuit interrupters.

1,264,420. Means for Producing Alternating Currents; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. Inverted rectifiers of the vapor type.

1,264,421. Electric Switch; Charles H. Miller, Milwaukee, Wis. App. filed Oct. 28, 1913. For automatic motor starters.

1,264,444. Induction Motor; George J. Schmidt, Wilkinsburg, Pa. App. filed Dec. 4, 1914. Method of controlling motors.

1,264,450. Outlet Box with Knock-Out Sections; Oliver T. Sweet, St. Louis, Mo. App. filed June 28, 1916. Easily and quickly removed at the time the box is installed.

1,264,465. Automatic Circuit-Closer Attachment for Telegraph Keys; James L. White, Buffalo, Tex. App. filed July 19, 1917. Automatically closing the line circuit to the next station immediately upon release of the key by the operator.

1,264,473. Combination Switch; Howard H. Baker, Buffalo, N. Y. App. filed July 24, 1915. Can be partly dismantled or taken apart for inspection or repairs without disclosing the combination.

1,264,482. Electric Connector for Dash Lamps, etc.; John Berg, Chicago, Ill. App. filed July 20, 1917. Means for securely mounting a dash lamp on an automobile.

1,264,507. Multi-Unit Telephone Transmitter; William W. Hanscom, San Francisco, Cal. App. filed Feb. 27, 1917. Adapted for wireless telephony.

1,264,517. Electric Impulse Sender; Henry J. Herink, London, England. App. filed Dec. 23, 1916. Improvements.

1,264,520. Flashlight Battery; Major E. Holmes, Lakewood, Ohio. App. filed March 2, 1914. Combination of a flashlight battery with a rheostat.

1,264,525. Portable Electric Light; Walter D. Kahn, New York, N. Y. App. filed Aug. 16, 1917. Flashlight.

1,264,529. Snap-Switch Device; Henry Kocourek, Jersey City, N. J. App. filed Jan. 22, 1917. For use with a solenoid.

1,264,535. Electrolysis of Chlorides; Karl P. McElroy, Washington, D. C. App. filed Dec. 9, 1915. Improvements.

1,264,536. Manufacture of Alkalis; Karl P. McElroy, Washington, D. C. App. filed June 22, 1915. By electrolysis.

1,264,544. Signal-Actuating Device for Motor Vehicles; Charles Nevin, Buffalo, N. Y. App. filed Sept. 9, 1915. Arranged on the steering wheel of a motor vehicle.

1,264,545. Signal-Actuating Device for Vehicles; Charles Nevin, Buffalo, N. Y. App. filed May 29, 1916. Arranged on the steering wheel of a motor vehicle.

1,264,546. Supporting Means for Electric Switches; William J. Newton, Lynbrook, N. Y. App. filed May 25, 1915. Adapted for the control of the ordinary lighting circuits of buildings.

1,264,560. Sparking Means for Motor Vehicles; Andrew L. Riker, Short Hills, N. J. App. filed July 16, 1902. For igniting the combustible in the engine cylinders.

1,264,593. Electric Water Purifier; Edward M. Barnes, Hastings, Mich. App. filed June 30, 1917. Improvements.

1,264,596. Automobile Signal; Joseph Basil and Emilio Stocchi, Detroit, Mich. App. filed April 30, 1917. Improvements.

1,264,611. Method of Electric Welding; William B. Cleveland, Cleveland, Ohio. App. filed June 11, 1915. Improvement on "Herrick" process of making a homogeneous mechanical juncture.

1,264,628. Distilling Process for Recovering Metals from Ores and Metal-Bearing Materials; Charles H. Fulton, St. Louis, Mo. App. filed April 21, 1917. Improvements.

1,264,629. Process for Recovering Mercury; Charles H. Fulton, St. Louis, Mo. App. filed April 21, 1917. Improvement.

1,264,671. Signal Box; Jacob F. Mehren, Chicago, Ill. App. filed Dec. 14, 1914. Readily accessible to the public to enable fire and police alarms to be sent in.

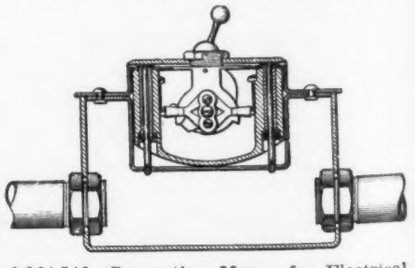
1,264,674. Insulation of Electricity; Erwin Moller, Brackwere, Germany. App. filed Aug. 10, 1909. Improvements.

1,264,685. Method of Making Electrical Contacts; Giuseppe A. Rignon, Genoa, Italy. App. filed Sept. 30, 1916. For the ignition of the explosive mixture in internal-combustion engines.

1,264,724. Electrical Fuel Vaporizer; William Wheeler, Brooklyn, N. Y. App. filed June 26, 1917. For use in internal-combustion motors.

1,264,749. Method of Building Armatures; Vincent G. Apple, Dayton, Ohio. App. filed Jan. 29, 1917. To secure inseparably the bar conductors within openings in the core of armatures so that holding bands become unnecessary.

1,264,979. Electric Contact Device; Gottlob Honold, Stuttgart, Germany. App. filed July 21, 1917. Mechanically controlled interrupters for use with the ignition devices of internal-combustion motors.



1,264,546—Supporting Means for Electrical Switch

1,264,802. Electrolysis of Sulphate of Cadmium Solution; Edwin J. Hunt and William T. Gidden, Warley, England. App. filed June 24, 1916. Improvements.

1,264,813. Current Amplifier; August J. Kloneck, New York, N. Y. App. filed May 29, 1914. For amplifying oscillatory currents between signaling stations.